OUTGOING LTR. NO.		
99-RF-01790		
DOE ORDER #		
DISTRIBUTION	LTR	ENC
BENSUSSEN, S.J.		
BORMOLINI, A.M.		
BRAILSFORD, M.D.		
BRYNER , C.J.		
BURDGE, L.		
CARD, R.G.		
COSGROVE, M.M.		
COX, C.		
CRAWFORD, A.C.		
DEJONG, V.J.		
FERRERA, D.W.		
FULTON, J.C.		
HARDING, W.A.		
MARTINEZ, L.A.		
PARKER, A		
POLSTON, S.		
SHELTON, D.C.		
TUOR, N.R.		
CORR CON / T130G	X	X
ADMIN REC / B116	X	X
PATS/T130G		
CLASSIFICATION:		
UCNI		
UNCLASSIFIED	✓	✓
CONFIDENTIAL		
SECRET		

AUTHORIZED CLASSIFIER SIGNATURE: [signature]
~~EXEMPT PER: CEX-200-95~~
Date: 5/7/99

IN REPLY TO RFP CC NO.:

ACTION ITEM STATUS:
☐ PARTIAL/OPEN
☐ CLOSED

LTR APPROVALS:

ORIG. & TYPIST INITIALS:
TS:kjs

KAISER•HILL
COMPANY

May 7, 1999 99-RF-01790

Matt McCormick
D&D Program Leader
DOE, RFFO

SUBMITTAL OF THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE (RFETS) DECONTAMINATION AND DECOMMISSIONING (D&D) PROTOCOL - MAN-077-DDCP-AND THE DRAFT RECONNAISSANCE LEVEL CHARACTERIZATION PLAN-BWM-012-99

Provided for your review and comment is the "Decontamination and Decommissioning Characterization Protocol, Revision 1 and the Reconnaissance Level Characterization Plan." The Protocol is being revised to reflect updates to free-release criteria and additional comments received form both the Department of Energy and Environmental Protection Agency. The Reconnaissance Level Characterization Plan is a new document, which defines "how" this level of characterization will be conducted for Type 1, 2 and 3 Facilities at the RFETS. This Plan will be included as an Appendix to the Protocol.

These documents contain site requirements for conducting facility characterizations on this Site as promulgated by the Rocky Flats Cleanup Agreement (RFCA), the Decommissioning Program Plan (DPP), and the Facility Disposition Program Manual (FDPM). Once approved and issued, Revision 1 of the Protocol, including the Plan, will replace Revision 0 dated November 20, 1998.

As we have discussed, it would be beneficial to include both the CHPHE and EPA in this review cycle. Their input, on previous drafts, has been valuable. We would be more than happy to provide additional copies for their review as well. In order to resolve comments, we would appreciate your comments on or before Friday, May 28. We plan on dispositioning comments beginning Monday, May 31.

Kaiser-Hill Company, L.L.C.
Courier Address: Rocky Flats Environmental Technology Site, State Hwy. 93 and Cactus, Rocky Flats, CO 80007 • 303.966.7
Mailing Address: P.O. Box 464, Golden, Colorado 80402-0464

During your review if you have questions or comments, please provide them to Tom Scott, D&D Closure Projects, Building 130, extension 2093.

Brian Mathis
Division Manager
D&D Projects
Kaiser-Hill Company, L.L.C.

RTS:kjs

Enclosure:
As Stated

Orig. and 1 cc - Matt McCormick

cc:
William Fitch
Fred Gerdeman
Keith Klein

Rocky Flats Environmental Technology Site

MAN-077-DDCP

DECONTAMINATION AND DECOMMISSIONING CHARACTERIZATION PROTOCOL

REVISION 1

APPROVED________________________________ /Brian Mathis ______ / __________

Division Manager, D&D Projects and Construction, Kaiser-Hill Company, LLC — Print Name — Date

CONCURRENCE BY THE FOLLOWING DISCIPLINES IS DOCUMENTED IN THE DOCUMENT HISTORY FILE:

Kaiser-Hill Company, L.L.C.	Prime Subcontractors:
Closure Projects Integration	Rocky Flats Closure Site Services, L.L.C.
Environmental Systems & Stewardship	Rocky Mountain Remediation Services, L.L.C.
General Counsel	Safe Sites of Colorado, L.L.C.
Nuclear Operations	
Safeguards, Security, Site Operations & Integration	
Safety Systems & Engineering	

USE CATEGORY 3

USQD Program Review: PRE-RFP-99.0255-ARS
ISR review: SORC-98-018

Reviewed for Classification / UCNI

By____________________________

Periodic review frequency: 3 years from effective date. Date ____________________

LIST OF EFFECTIVE PAGES

Pages	Effective Date
1-59	TBD

TABLE OF CONTENTS

CHAPTER/SECTION **PAGE**

EXECUTIVE SUMMARY

Kaiser-Hill Company, L.L.C. (K-H), the U.S. Department of Energy/Rocky Flats Field Office (DOE/RFFO), the Colorado Department of Public Health and Environment (CDPHE), and the U.S. Environmental Protection Agency (EPA) agree that building and facility characterization needs to be consistent when applied throughout the decommissioning program. To support this effort, the EPA Data Quality Objective (DQO) process **SHALL** be applied to the characterization process across the Special Nuclear Materials (SNM) Consolidation, Decontamination and Decommissioning (D&D) Program.

The Rocky Flats Environmental Technology Site (RFETS or Site) D&D Characterization Protocol implements the requirements of the Facility Disposition Program Manual and provides direction for conducting characterizations within Type 1, 2 and 3 facilities. The NUREG 1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), issued in December 1997, and this document describe the key D&D characterization phases, establishes DQOs for the various phases, and presents related quality assurance and data review requirements. This document is to be used in preparing project-specific documents that comply with the Rocky Flats Cleanup Agreement (RFCA).

ABBREVIATIONS/ACRONYMS

ACM	Asbestos-containing material
CCR	Code of Colorado Regulations
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
D&D	Decontamination and Decommissioning
COC	Contaminant of concern
DOE	U.S. Department of Energy
DOP	Decommissioning Operations Plan
DPP	Decommissioning Program Plan
DQA	Data Quality Assessment
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
HASP	Health and Safety Plan
HRR	Historical Release Records
HSA	Historical Site Assessment
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
IPC	In-Process Characterization
K-H	Kaiser-Hill Company, L.L.C.
LLMW	Low-Level Mixed Waste
LLW	Low-level Waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum Detectable Activity
Mg/l	Milligram/Liter
MRI	Midwest Research Institute
NRA	No Radiation Added
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PATS	Plant Action Tracking System
PCBs	Polychlorinated Biphenyl's
PDS	Pre-Demolition Survey
PDSP	Pre-Demolition Survey Plan
PDSR	Pre-Demolition Survey Report
PE	performance evaluation
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control

QAPjP	Quality Assurance Project Plan
QAP	Quality Assurance Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
RIRs	Radiological Improvement Reports
RLC	Reconnaissance Level Characterization
RLCP	Reconnaissance Level Characterization Plan
RLCR	Reconnaissance Level Characterization Report
SAP	Sampling and Analysis Plan
SNM	Special Nuclear Materials
SOW	Statement of Work
TCLP	Toxicity Characteristic Leaching Procedure
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
UCL	Upper Confidence Level
V&V	Verification and Validation
WAC	Waste Acceptance Criteria
WSRIC	Waste Stream Residue Identification and Characterization

1.0 PURPOSE

The Rocky Flats Cleanup Agreement (RFCA, 7/96) establishes the regulatory framework for cleanup and closure of the RFETS. Building disposition, including D&D, is an integral part of RFCA that requires the development and implementation of a building characterization program at RFETS. Characterization is the process of identifying the chemical and radiological hazards associated with a building or building cluster. Information gathered during characterization **SHALL** be used to support facility disposition, including selection of decommissioning alternatives and the development of project-specific documentation.

This protocol presents the requirements for characterizing buildings when developing D&D alternatives for Type 1, 2 and 3 facilities, as defined in the Decommissioning Program Plan (DPP) and Section 2 of this document. Details on implementing characterization requirements are provided in the K-H Site-Wide Reconnaissance Level Characterization Plan (RLCP) and the K-H Site-Wide Pre-Demolition Survey Plan (PDSP). K-H will use characterization data to review and evaluate the risks associated with D&D, and to define management options for building disposition.

Characterization **SHALL** be accomplished through the implementation of the EPA DQO process and the application of approved and accepted characterization practices and methods. Documents used to develop this protocol include:

- Guidance for the Data Quality Objectives Process, QA/G-4, September 1994, (EPA/600-R-96/005);
- Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Final, December 1997 (NUREG-1575, EPA 402-R-97-016);
- Decommissioning Resource Handbook, DOE/EM, August 1995;
- DOE/RFFO, CDPHE, EPA, Final Rocky Flats Cleanup Agreement (RFCA), July 19, 1996; and
- 40 CFR, Protection of the Environment, and 6 CCR 1007.

1.1. OBJECTIVE

The primary objective of this document is to provide a compliant, consistent and systematic approach to characterizing the radiological and chemical hazards associated with buildings and building clusters at RFETS. A key tool to ensuring a consistent approach and defining the basis for characterization is the application of EPA's DQO process. Additional document objectives include clarifying information for the stakeholders and assisting in the development of technically sound characterization documents, based on a common, consistent set of processes, protocols, DQOs and decision rules. The following are benefits of using the proposed characterization approach:

- Enhanced stakeholder understanding, D&D program credibility, and RFETS productivity;
- Expedited approval of project-specific plans and decision documents;
- Consolidated guidance for RFETS project managers;
- Pollution prevention; and
- Cost savings.

The implementation of the Protocol is a component of the RFETS Integrated Safety Management System. The Protocol requires the characterization of building hazards and the evaluation of characterization data throughout the D&D process to ensure that controls remain adequate to protect RFETS workers, the public, and the environment.

1.2. SCOPE OF THIS DOCUMENT

This document consists of seven main sections and appendices. Section 2 is an overview of the four phased characterization process, and Section 3 contains a description of EPA's seven-step DQO process and its application to D&D characterization. Section 4 defines the DQOs for characterization of Type 1 facilities and presents the related documentation requirements. Section 5 defines the DQOs for characterization of Type 2 and 3 facilities and the corresponding documentation requirements. The sampling and analysis requirements for non-radioactive contaminants of concern are identified or referenced in Section 6. Section 7 discusses quality assurance and the type of data reviews required to ensure sufficient data quantity and quality. Section 8 identifies the references used in preparing this manual.

This document also provides references to applicable regulations and to various characterization guidance documents and procedures. In addition, it references other D&D program documents and Site infrastructure programs that should be used during D&D characterization, such as the Facility Disposition Program Manual (FDPM), the RLCP, and the PDSP. Appendix A, The RFETS Characterization Process, defines the process and requirements as they apply to SNM Programs, Type 1, 2 and 3 Facilities, and Government and Subcontractor Equipment. Those steps in the process to which the D&D Characterization Protocol applies, are shaded to reflect the need for D&D characterization data. Appendix B, The D&D Characterization Process Logic Diagram, illustrates the D&D characterization process at RFETS with respect to facility type, phase, and documentation requirements

This document does not address characterization associated with the closure of RCRA waste management units. RCRA closures and characterization are conducted pursuant to the RCRA Closure Plans and addressed in individual Closure Description Documents.

This document does not address remediation of under building contamination or evaluation of characterization data to determine impacts on environmental media such as soil, surface and ground water, and air, and to assess compliance with related environmental regulations. The evaluation of impacts to environmental media and related regulations is addressed in the RFETS Integrated Monitoring Plan (IMP). Investigation and remediation of under building contamination will be managed by the RFETS Closure Projects Environmental Restoration Program.

This document does not specify sampling and survey methods, determination of sample locations and survey points, the number of samples to be collected, the size and geometry of survey grids, the analyses required, or detection limits. These details are facility specific and will be developed for and incorporated into facility-specific plans using the guidance provided in the Protocol, the RLCP and the PDSP.

1.3. USE OF THIS DOCUMENT

This document applies to all site employees and subcontractors. It is to be used to select and refine DQOs, and as a tool to plan required characterization activities based on facility-specific conditions. The DQOs are selected based on facility type and decontamination phase. Any exceptions from the requirements of this document must be obtained, in writing, from the Division Manager, D&D Projects and Construction.

Several buildings have already initiated the characterization process. These buildings will be required to use this Protocol and characterization processes methods, and data verification and validation (V&V) specified in the Protocol. However, the specific deliverables will not be required if the building has already provided similar deliverables. All future characterization efforts **SHALL** be in accordance with Protocols.

The type and extent of characterization depend on the building disposition decision. D&D Project Managers should involve various subject matter experts early in the planning process to develop cost-effective disposition options, focus characterization needs, and save money for other closure activities. The following minimum disciplines should be involved in planning and formulation of DQOs:

- D&D technology;
- Radiological protection/nuclear safety;
- Environmental protection/compliance;
- Waste management;
- Occupational safety; and
- Industrial hygiene.

2.0 OVERVIEW OF THE CHARACTERIZATION PROCESS

Characterization is the process of identifying the chemical and radiological hazards associated with a building or building cluster. The following four characterization/verification phases were identified for use at RFETS:

1. Scoping Characterization/Historical Site Assessment (HSA);
2. Reconnaissance Level Characterization (RLC);
3. In-Process Characterization (IPC); and
4. Pre-Demolition Survey (PDS).

These four phases were derived from the following documents: DOE/EM0142P, Manual for Conducting Radiological Surveys in Support of License Termination; DOE/EM, The Decommissioning Resource Handbook; NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM); and DOE Order 5820.2A, Radioactive Waste Management.

Characterization and decommissioning activities **SHALL** be performed in accordance with applicable regulatory requirements, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), Colorado Hazardous Waste Act (CHWA), RFCA, and U.S. Department of Transportation regulations (49CFR). In addition, characterization activities **SHALL** be controlled by various RFETS D&D program manuals, guidance documents, and procedures (e.g., the Integrated Work Control Program, the Integrated Safety Management System, Conduct of Operations Manual, the DPP, the FDPM, the RLCP, the PDSP, and RFETS Waste Management and Transportation manuals and procedures).

Through the characterization process, each RFETS facility will be classified based on the level of potential or existing radiological material and/or hazardous substance contamination. Hazardous substances are listed in 40 CFR 302.4. Anticipated classification will be based on historical information and process knowledge. Site facilities will be classified, per the DPP, as one of the following three types:

Type 1 facilities are "free of contamination." A facility is considered free of contamination if all of the following statements can be made or are not applicable:

- Hazardous wastes generated and/or stored in the facility have been previously removed in accordance with CHWA and RCRA requirements;
- RCRA units have been closed, parts of the unit within the facility have been certified as being clean closed, or the unit is in a RCRA stable configuration;
- Routine surveys for radiological contamination performed pursuant to the RFETS radiological protection program show the building is not contaminated;

- Surveys for hazardous substance contamination indicate the building is not contaminated; and
- Hazardous substances, including polychlorinated biphenyls (PCBs) and asbestos, are an integral part of the building's structural, lighting, heating, electrical, insulation, or decorative materials.

Type 2 facilities contain some radiological contamination or hazardous substance contamination. The extent of the contamination is such that routine methods of decontamination should suffice and only a moderate potential exists for environmental releases during decommissioning. Some buildings in this category, e.g., buildings 865, 886, and 991, may require deactivation in certain areas prior to decommissioning. A building is not considered a Type 3 building just because deactivation is required. Buildings with industrial operations utilizing hazardous substances and/or radioactive materials will be classified as Type 2.

Type 3 facilities contain extensive radiological contamination, usually as a result of plutonium processing operations or accidents. Contamination may exist in gloveboxes, ventilation systems, or the building structure. Buildings that were used for plutonium component production, along with the major support buildings are expected to be classified as Type 3. These buildings include: 371/374, 559, 771/774, 707, 776/777, and 779.

2.1. SCOPING CHARACTERIZATION/HISTORICAL SITE ASSESSMENT (HSA)

The Scoping Characterization/HSA phase establishes the project scope and the anticipated facility type. The project scope definition includes identifying the physical boundaries of the areas to be characterized. The boundaries may include a cluster of related buildings, a single building, or a room/area within a building. Establishment of the anticipated facility type requires information regarding building hazards, including hazardous and radiological conditions. Information gathering activities include building walk-downs, interviewing building personnel, and reviewing historical and operational building information. Historical/building data may include historical surveys, Safety Analysis Reports, records, incident reports, radiological improvement reports (RIRs), Plant Action Tracking System (PATS), Historical Release Reports (HRRs), and any other pertinent Waste Stream Residue Identification and Characterization (WSRIC) information. In addition, radioactive sources **SHALL** be evaluated.

The HSA is an important component of scoping because it consolidates the existing facility historical information. The HSA **SHALL** include the following minimum information:

- Identification of the potential, likely, or known sources of radiological material/hazardous substances and/or contamination, including history and nature of material/substance storage, use, spills, and waste handling;

- A preliminary assessment of contaminant migration including migration pathways and human and environmental targets;
- Information that may be useful in other characterization phases; and
- A recommendation on whether further action is warranted.

Scoping provides a basis for preliminary evaluations of decommissioning efforts and aids in identifying the need for more extensive Reconnaissance Level Characterization (RLC) and In-Process Characterization (IPC) surveys. Scoping should be accomplished by the project team at the outset of a project. The result of this analysis should provide the information necessary to determine an initial facility classification or a modification to the classification. Results **SHALL** be incorporated into the RLC Report (RLCR).

2.2. RECONNAISSANCE LEVEL CHARACTERIZATION (RLC)

This phase of characterization provides an overall assessment of the contamination, hazards, and other conditions associated with each building. The radiological and chemical (including PCBs and asbestos) condition of the building **SHALL** be assessed to identify radioactive or hazardous waste storage areas, contaminated areas and hazards, and physical obstacles or conditions that could affect decommissioning activities. The RLC should obtain sufficient data to establish the basis for decommissioning activities.

This phase **SHALL** include the review and comparison of information gathered during scoping characterization to identify data gaps and determine the need for additional sampling/surveys. If data gaps are identified during the DQO process, additional sampling/surveys **SHALL** be conducted using the RLCP and contaminant-specific procedures. If data gaps are not identified, additional sampling/surveys are not required, and the RLCR is prepared. This report identifies the proposed facility classification to the DOE, the CDPHE, and the EPA.

2.3. IN-PROCESS CHARACTERIZATION (IPC)

This phase of characterization is used to evaluate on-going D&D activities, validate project plans and engineering alternatives, identify additional hazards that may be uncovered during facility strip-out and decontamination, confirm the adequacy of decontamination, determine residual levels of contamination, guide pre-demolition survey planning, and ensure that adequate data are obtained for waste management and transportation purposes. No formal plan is required for agency approval, however, sampling and analysis **SHALL** be documented for this phase. If extensive sampling and analysis is deemed necessary during this phase, a formal plan may be written to provide a systematic approach for data collected during this aspect of characterization. The plan may include, but is not limited to, Quality Assurance/ Quality Control (QA/QC) requirements, survey/sampling instructions, analysis requirements, and data reduction techniques. Applicable results **SHALL** be documented in the PDS Plan and Report.

2.4. PRE-DEMOLITION SURVEY (PDS)

This phase of characterization is performed after strip-out and/or decontamination are complete and before building disposition. This characterization **SHALL** be used to ensure that the building surfaces and/or structures meet applicable release criteria for radiological and non-radiological constituents per the DQOs. PDS instructions are presented in the PDSP. Results **SHALL** be documented in the PDS Report (PDSR).

2.5. INDEPENDENT VERIFICATION AND VALIDATION

Characterization data assessment is conducted to evaluate whether the data gathered during the characterization process meets the objectives of the Protocol and to ensure that the data are sufficient to assure compliance. Verification and Validation (V&V) are the final steps in the data life cycle. These steps assure that requirements prescribed in the RLC and the PD Plans were implemented correctly, and that the data gathered during characterization was performed within established quality control requirements.

Section 7.0 describes the quality assurance data review process and defines the requirements associated with data V&V per this protocol. In addition to this Protocol, the DOE may elect to have an "independent V&V" performed on data gathered during characterization. Type 1 facilities, considered "free of contamination", will have V&V performed on random facilities, while the Type 2 and 3 facilities will undergo mandatory V&V.

3.0 DATA QUALITY OBJECTIVES (DQOs)

This section describes the EPA DQO process and its application to D&D characterization at RFETS. Establishing characterization requirements **SHALL** involve identifying the decisions to be made, as well as the data needed to make these decisions. Implementation of EPA's DQO process will determine the data needs of each D&D project, and optimize the number and types of measurements and analyses relative to the available resources and ultimate project decisions.

3.1. DQO PROCESS

The DQO process is a systematic means to ensure that data are acquired and evaluated according to their intended use. Coupled with V&V, DQOs establish a framework that is legally and technically defensible so that decisions based on the data will be legally and technically defensible. The DQO process involves the following seven steps:

1. State the Problem;
2. Identify the Decision;
3. Identify the Inputs to the Decision;
4. Define the Boundaries of the Decision;
5. Develop the Decision Rule;
6. Specify Tolerable Limits on Decision Errors; and
7. Optimize the Design for Obtaining Data

3.1.1. The Problem

The initial problem is that definitive quantities and types of contaminated media, materials, equipment, and structures are not known and must be determined before an approach to D&D and the management of waste streams can be developed. Surveys/samples must be taken prior to demolition to properly characterize and manage the materials and/or equipment resulting from the D&D process. An additional complication is that the end use of the material, equipment, facility, or structure is unknown. A D&D project team should ensure that while completing the problem assessment that the reason for performing the characterization is adequately addressed.

3.1.2. The Decision

Since D&D decisions determine data needs, the decisions must be clear and well defined so that data needs are clearly defined. The following are examples of critical technical decisions:

- The types and quantities of materials, media, or equipment within the facility or area that are contaminated and not contaminated need to be clearly defined.
- The waste stream categories that will result from the activity need to be defined. The categories may include hazardous, non-hazardous, radiological, and mixed wastes.
- The ultimate disposition of the waste streams including quantities relative to the waste acceptance criteria (WAC) needs to be defined. The disposition should include the waste classification and the treatment, storage, and disposal facility(s).

3.1.3. Inputs to the Decisions

Inputs to the decisions include both qualitative and quantitative data. Qualitative information typically consists of process knowledge derived from operating records and interviews, and nominal data derived from visual observation of a building's equipment and materials. Quantitative data may be produced from analytical, radiation and other field surveys, and/or petrographic (asbestos) analysis of samples. Input may also include historical data, if the historical data can be validated. Inputs to the decision may include the following:

- Analytical results;
- Analytical quality control (QC) data;
- Radiological survey results;
- Radiological survey QC data;
- Method-specific sensitivities (e.g., detection limits or minimum detectable activities);
- Error tolerances associated with the measurements (e.g., accuracy and precision); and
- Action levels (e.g., regulatory thresholds from RFETS free-release criteria or RFCA).

The WAC and associated implementing procedures are typically the drivers for decision inputs where data will be used to characterize waste streams destined for a particular TSDF (e.g., Waste Isolation Pilot Plant, Nevada Test Site, Envirocare or USA Waste). Inputs to the decisions will be contaminant of concern (COC)-specific. Waste types also will be categorized by COC.

3.1.4. Decision Boundaries

Decision boundaries include the geographic area(s), volume(s), and temporal boundaries of the characterization activity. Temporal boundaries are generally reflected in environmental regulations and refer to frequency of data collection, the period of time a standard cannot be exceeded, and the period of time over which data should be averaged. Other means of defining the project boundaries are determining the sample population of interest and any constraints on the data collection.

3.1.5. Decision Rules

Decision rules are a series of "if-then" rules developed to establish the basis on which decisions are made. Decision rules must be based on objective, reproducible, and measurable criteria, and must be consistent with information developed during the first four steps of the DQO process. All decision rules **SHALL** be considered prior to finalizing the characterization plan.

3.1.6. Tolerable Limits on Decision Errors

The amount of acceptable uncertainty associated with characterization results must be established in the planning phases of the D&D activity and accepted by mutual consensus of the parties involved, i.e., K-H and their related subcontractor(s), and the DOE RFFO. Concurrence or approval from the affected parties is documented with formal correspondence and/or signature pages contained within the controlled documents.

The adequacy of the sampling set, relative to the number of samples taken, is also determined in this step of the DQO process. The number of samples required is determined by the acceptable limit of decision errors. The less errors that are acceptable, the more samples need to be taken. Based on the amount of error, or risk, that the project is willing to accept, the number of required samples can be calculated through EPA QA/G-4 and/or Cost Benefit Enhancements (DOE/EM-0316).

Acceptable false positive and negative errors generally range from 1% to 10%. In this protocol, the initial acceptable decision error limit is 5%, which translates to an upper confidence level (UCL) of 95%. Other limits may be used, if specified in the RLCP or PDSP or negotiated by the D&D Program with the LRA.

3.1.7. Optimization of Design

The DQOs may be modified in response to documented visual observations, data gaps, and professional judgment. If data gaps are identified as the project progresses or new information becomes available, additional sampling may be necessary. The sampling design is modified and optimized until the required, minimum confidence is achieved for the associated project decisions. The design may go through several iterations of optimization, depending on the sample data available and the inferences made from each unique sample set.

3.2. APPLICATION OF DQOs TO THE D&D CLOSURE PROGRAM

DQOs presented in this document **SHALL** be selected, refined as necessary, and incorporated into characterization planning documents based on the type of facility being decommissioned and the phase of decommissioning. Type 1 facilities **SHALL** undergo a combined RLC and PDS before being dispositioned (see Section 4.0). Type 2 and 3 facilities will undergo RLC, IPC, and PDS, with each phase of characterization using a different set of DQOs (see Section 5.0).

Data sets from previous characterizations serve as a key input to each characterization phase and its related set of DQOs. Such data can significantly assist in focusing on the next characterization phase, thereby resulting in time and cost savings. The usability of previous data will depend on its quality. If the data was not collected under a quality program and/or cannot be validated as accurate, it cannot be used.

A means to ensure adequate data quality is adherence to this characterization protocol, as well as the RLCP and the PDSP throughout facility disposition and characterization activities. Characterization results are to be used by the project team to make various D&D decisions, such as technology selection, alternatives development, material release, and waste management. Results will also be used by other K-H Team organizations to make other project-related decisions associated with occupational safety, industrial hygiene, environmental protection, regulatory compliance, etc. Therefore, D&D project personnel **SHALL** provide characterization results to all appropriate K-H Team organizations.

4.0 TYPE 1 FACILITIES

This section defines the DQOs for characterization of Type 1 facilities, and presents the related documentation requirements. If contamination is encountered during characterization, the facility may be re-categorized, and characterization requirements **SHALL** be modified (see Appendix B). Documentation requirements for Type 1 facilities include a combined RLC/PDS report.

4.1. DQOs FOR RCL/PDS

Only one set of DQOs **SHALL** be used for the combined RLC and PDS. The following sections outline the DQO process utilizing the seven steps.

4.1.1. The Problem

The problems associated with Type 1 facilities involve quantifying the amount of material, media, equipment, floors, walls and ceilings, interior/exterior to the buildings. In addition, the adequacy of the HSA and process knowledge/history data addressing the nature and extent of radiological and hazardous substance contamination needs to be assessed to determine if the material, media, equipment, floors, walls and ceilings can be considered to be sanitary waste or free-released.

4.1.2. The Decision

The critical decisions associated with Type 1 facilities are determining the inventory of material and evaluating characterization data. The material inventory should include an estimate of the media, equipment, floors, walls, ceilings, and interior/exterior of buildings. Characterization data evaluation will involve assessing if there is enough validated data to determine if the building materials are considered sanitary waste or free-released.

4.1.3. Inputs to the Decision

The inputs to the decision with respect to Type 1 facilities include the characterization data from scoping/HSA, applicable action levels, unrestricted release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, and WAC.

4.1.4. Decision Boundaries

The characterization boundaries are limited to the spatial confines of the facility itself and materials, equipment, equipment components, and media that make-up or are within the buildings, both interior and exterior. As a result, the spatial confines of the building in two or three dimensions will be defined during this step using engineering drawing when available. The accuracy of the drawings **SHALL** be verified prior to use. In addition, the temporal aspects of the project and applicable regulations will be included in the definition of the decision boundaries (refer to section 3.1.4).

4.1.5. Decision Rules

This section develops the rules in which decisions are made concerning characterization data. There are some very specific rules and rules related to COC. The following are general guidelines for decision making: If there is an inventory/estimate of remaining materials, media, equipment, floors, walls and ceilings within the building, no inventory/estimates are necessary; otherwise, inventory/estimates are necessary. If materials are found to be non-radioactive, non-hazardous, non-beryllium contaminated, non-TSCA and non-asbestos containing material (ACM), then material can be free-released or managed as sanitary waste.

Radionuclides

The following criteria may be used to determine if Type 1 facility contains radionuclide contamination:

- If process knowledge/history supports the premise that no radioactive contamination is present, the related area and/or volume of material is considered sanitary waste or may be free-released.
- If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5 (Radiation Protection of the Public and Environment) and/or are within background concentrations for volume contaminated material (refer to Radiological Safety Practices 09.03, "Unrestricted Release of Bulk or Volume Material), the related area or volume of material is considered sanitary waste or may be free-released.
- If all radiological sample measurements are below the volume contamination thresholds provided in the No-Rad-Added Verification (NRA) Program, the related volume of material is considered sanitary waste or may be free released.
- If any radiological survey measurements exceed the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered low-level waste (LLW).
- If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material is considered LLW.
- If any radiological sample measurements exceed 100 nanocuries/gram of plutonium and/or americium for volume contaminated material, the related volume of material is considered transuranic (TRU) waste.

RCRA Constituents

If the waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Part 261. If the waste is free from listed hazardous waste and hazardous characteristics, the waste is considered non-hazardous.

Beryllium

If detectable beryllium contamination can be shown through process knowledge to consist of beryllium powder (P015 under RCRA), then the contaminated materials will be treated as RCRA waste and subject to treatment standards under 40 CFR 268.40, or RFETS will propose release criteria for the material based upon surveys and available information. If beryllium in any form is identified that meets the criteria for an underlying hazardous constituent, it will be subject to Universal Treatment Standards as in 40 CFR 268.48.

If concentrations of beryllium are equal to or greater than 0.2 ug/100 cm^2, the material is considered beryllium contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28, Chronic Beryllium Disease Prevention Program. If the concentrations are below 0.2 ug/100 cm^2, the material is considered non-beryllium contaminated.

PCBs

If material meets the definition of "Bulk Product Waste," it may be disposed of as TSCA waste at a permitted solid waste disposal facility without further characterization (Federal Register, Vol. 63, No. 124, June 29, 1998, 40 CFR §761.62). If the disposal facility does not possess a commercial PCB storage or disposal approval, the generator must provide written notification to the facility in accordance with §762.62.

If material meeting the definition of Bulk Product Waste is to be free-released (e.g., recycled), the 95% upper confidence limit of the mean value of a representative sample set cannot exceed 50 ppm. This determination can be made through process knowledge or laboratory analysis.

If material meets the definition of PCB remediation waste (i.e., potentially containing PCBs from historical releases; §761.61), the free-release concentration is $\leq$ 1 ppm PCBs, as determined in accordance with requirements of §761.61, Subpart G. Higher release levels for PCB remediation wastes are permissible, but carry specific restrictions on disposition of the material.

Asbestos

In accordance with 40 CFR 763 and 5 CCR 1001-10, if any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e., >1% by volume), then material is considered ACM; otherwise the material is considered non-ACM.

4.1.6. Tolerable Limits on Decision Errors

The maximum value for false positive and false negative errors is 5% when calculating the number of samples required. Decision error does not apply to asbestos sample sets per 40 CFR 763. Results are compared with the action levels on a sample-by-sample basis.

4.1.7. Optimization of Plan Design

The following criteria provide potential areas for optimization of the Type 1 characterization plans:

- If radiological, RCRA, TSCA and asbestos survey/samples are not required per the DQO process; additional surveying and sampling are not required.
- If RCRA, TSCA or asbestos survey/samples are required for materials, media, equipment, floor, wall and ceilings, refer to Section 6.0.
- If radiological survey/samples are required for floors, walls and ceilings, then the following requirements apply:

    1. A statistically based radiological survey/sampling program **SHALL** be developed per the requirements in Section 5.0 of the MARSSIM.
    2. The location of radiological survey/sampling points **SHALL** be delineated per the requirements in Section 5.5 of the MARSSIM.
    3. Radiological field measurement methods and instrumentation **SHALL** be delineated per the requirements in Section 6 of the MARSSIM.
    4. Radiological sampling and preparation for laboratory measurements **SHALL** be delineated per the requirements in Section 7 of the MARSSIM.

- If radiological survey/samples are required for materials, media and equipment, then a radiological survey/sampling plan **SHALL** be developed per the requirement in Health and Safety Plan (HSP) 18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste.

4.2. RLC/PDS REPORT

The characterization process results for Type 1 facilities are documented in an RLC/PDS Report. The report **SHALL** provide an analysis of the characterization/survey results and summarize the hazards and risks associated with them. The report **SHALL** document the process knowledge and history (HSA) and/or characterization survey results that demonstrates the building can be managed as sanitary waste. **An outline for the RLC/PDS Report is presented in Appendix C.**

Final reports containing survey and analytical results **SHALL** describe the results of QC measurements, applicable audits, and confirmation sample comparisons performed for each sampling and analysis task. Any quality problems associated with the data **SHALL** be documented with the corrective actions taken in response to the deficiencies identified. Data review requirements are discussed in Section 7.0.

5.0 TYPE 2 AND TYPE 3 FACILITIES

This section defines the three possible sets of DQOs that may be associated with the three characterization phases and related documentation requirements for Type 2 and Type 3 facilities: RLC, IPC, and PDS. DQOs for each of these characterizations are outlined in Sections 5.1, 5.2, and 5.3. Documentation requirements for Type 2 and Type 3 facilities are presented in Section 5.4.

5.1. DQOs FOR RLC

The following sections outline the DQO process utilizing the seven steps for RLC.

5.1.1. The Problem

The problems associated with Type 2 and 3 facilities involve quantifying the amount of material, media, equipment, floors, walls and ceilings, interior/exterior to the buildings. In addition, the adequacy of the HSA and process knowledge/history data addressing the nature and extent of radiological and hazardous substance contamination needs to be assessed to determine if the material, media, equipment, floors, walls and ceilings can be free-released or considered to be sanitary waste, LLW, low-level mixed waste (LLMW), transuranic (TRU) waste, TRU mixed waste, RCRA waste, TSCA waste, or asbestos-containing waste.

5.1.2. The Decision

The critical decisions associated with Type 2 and 3 facilities are determining the inventory of material and evaluating characterization data. The material inventory should include an estimate of the media, equipment, floors, walls, ceilings, and interior/exterior of buildings. Characterization data evaluation will involve assessing if there is enough validated data to determine if the building materials are considered sanitary waste, LLW, LLMW, TRU waste, TRU mixed waste, RCRA waste, TSCA waste, or asbestos-containing waste, and to meet transportation requirements.

5.1.3. Inputs to the Decision

The inputs to the decision with respect to Type 2 and 3 facilities include the magnitude and location of data from scoping characterization and applicable action levels, unrestricted release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, and WAC.

5.1.4. Decision Boundaries

The characterization boundaries are limited to the spatial confines of the facility itself and materials, equipment, equipment components, and media that make-up or are within the buildings, both interior and exterior. As a result, the spatial confines of the building in two or three dimensions will be defined during this step using engineering drawings when available. The accuracy of the drawings **SHALL** be verified prior to use. In addition, the temporal aspects of the project and applicable regulations will be included in the definition of the decision boundaries.

5.1.5. Decision Rules

This section develops the rules in which decisions are made concerning characterization data. There are some very specific rules and rules related to COC. The following are general guidelines for decision rule development:

- If there is an inventory/estimate of remaining materials, media, equipment, floors, walls and ceilings within the building, no inventory/estimates are necessary; otherwise, inventory/estimates are necessary.
- If materials are found to be non-radioactive, non-hazardous, non-beryllium contaminated, non-TSCA and non-ACM, then material can be free-released or managed as sanitary waste.

Radionuclides

The following criteria may be used to determine if Type 2 and 3 facilities contains radionuclide contamination:

- If process knowledge/history supports the premise that no radioactive contamination is present, the related area and/or volume of material is considered sanitary waste or may be free-released.
- If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5 (Radiation Protection of the Public and Environment) and/or are within background concentrations for volume contaminated material, the related area or volume of material is considered sanitary waste or may be free-released.
- If all radiological sample measurements are below the volume contamination thresholds provided in the NRA Program, the related volume of material is considered sanitary waste or may be free released.
- If any radiological survey measurements exceed the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered LLW.
- If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material is considered LLW.
- If any radiological sample measurements exceed 100 nanocuries/gram of plutonium and/or americium for volume contaminated material, the related volume of material is considered TRU waste.

RCRA Constituents

If the waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Part 261. If the waste is free from listed hazardous waste and hazardous characteristics, the waste is considered non-hazardous.

Beryllium

If detectable beryllium contamination can be shown through process knowledge to consist of beryllium powder (P015 under RCRA), then the contaminated materials will be treated as RCRA waste and subject to treatment standards under 40 CFR 268.40, or RFETS will propose release criteria for the material based upon surveys and available information. If beryllium in any form is identified that meets the criteria for an underlying hazardous constituent, it will be subject to Universal Treatment Standards as in 40 CFR 268.48.

If concentrations of beryllium are equal to or greater than 0.2 ug/100 cm^2, the material is considered beryllium contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28, Chronic Beryllium Disease Prevention Program. If the concentrations are below 0.2 ug/100 cm^2, the material is considered non-beryllium contaminated.

PCBs

If material meets the definition of "Bulk Product Waste," it may be disposed of as TSCA waste at a permitted solid waste disposal facility without further characterization (Federal Register, Vol. 63, No. 124, June 29, 1998, 40 CFR §761.62,). If the disposal facility does not possess a commercial PCB storage or disposal approval, the generator must provide written notification to the facility in accordance with §762.62.

If material meeting the definition of Bulk Product Waste is to be free-released (e.g., recycled), the 95% upper confidence limit of the mean value of a representative sample set cannot exceed 50 ppm. This determination can be made through process knowledge or laboratory analysis.

If material meets the definition of PCB remediation waste (i.e., potentially containing PCBs from historical releases; §761.61), the free-release concentration is ≤1 ppm PCBs, as determined in accordance with requirements of §761.61, Subpart G. Higher release levels for PCB remediation wastes are permissible, but carry specific restrictions on disposition of the material.

Asbestos

In accordance with 40 CFR 763 and 5 CCR 1001-10, if any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e., >1% by volume), then material is considered ACM; otherwise the material is considered non-ACM.

5.1.6. Tolerable Limits on Decision Errors

The maximum value for positive and false negative errors is 5% when calculating the number of samples required for RCRA and TSCA characterization. No statistically based sample sets are required for radionuclides; therefore, decision errors do not apply. Decision error does not apply to asbestos sample sets per 40 CFR 763 and 5 CCR 1001-10. Results are compared with the action levels on a sample-by-sample basis.

5.1.7. Optimization of Plan Design

Subjective radiological surveying/sampling will be conducted, pursuant to the RLCP, to initially classify materials, media, equipment, floors, walls and ceilings as sanitary, LLW and TRU waste for decontamination and waste classification purposes. The following criteria provide areas for optimization of radiological survey/sampling plan:

- Radiological field measurement methods and instrumentation are described in Section 6 of MARSSIM.
- Radiological sampling and preparation for laboratory measurements are described in Section 7 of MARSSIM.
- If RCRA, TSCA or asbestos survey samples are required for materials, media, equipment, floors, walls and ceilings, refer to Section 6.0.

5.2. DQOs for IPC

The following sections outline the DQO process utilizing the seven steps for IPC.

5.2.1. The Problem

The problems associated with Type 2 and 3 facilities during strip-out involve quantifying the amount of material, media, equipment, floors, walls and ceilings, interior/exterior to the buildings. In addition, the adequacy of the HSA and process knowledge/history data addressing the nature and extent of radiological and hazardous substance contamination needs to be assessed to determine if the material, media, equipment, floors, walls and ceilings can be free-released or considered to be sanitary waste, LLW, LLMW, TRU waste, TRU mixed Waste, RCRA waste, TSCA waste, or ACM-containing waste.

5.2.2. The Decision

The critical decisions associated with Type 2 and 3 facilities during strip-out are determining the inventory of material and evaluating characterization data. The material inventory should include an estimate of the media, equipment, floors, walls, ceilings, and interior/exterior of buildings. Characterization data evaluation will involve assessing if there are enough validated data to determine if the building materials are considered sanitary waste, LLW, LLMW, TRU waste, TRU mixed waste, RCRA waste, TSCA waste, or ACM-containing waste, and to meet transportation requirements.

5.2.3. Inputs to the Decision

The inputs to the decision with respect to Type 2 and 3 facilities include the magnitude and location of data from preceding characterizations, including data from scoping characterization, and contained in the RLCR, DOP, and the IM/IRA and the applicable action levels, unrestricted release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, and WAC.

5.2.4. Decision Boundaries

The characterization boundaries are limited to the spatial confines of the facility itself and materials, equipment, equipment components, and media that make-up or are within the buildings (interior and exterior). As a result, the spatial confines of the building in two or three dimensions will be defined during this step using engineering drawings when available. The changes to facility/room configuration and content resulting from strip-out and decontamination activities and newly accessible and decontaminated areas need to be identified. In addition, the temporal aspects of the project and applicable regulations will be included in this definition.

5.2.5. Decision Rules

This section develops the rules in which decisions are made concerning characterization data. There are some very specific rules and rules related to COC. The following are general guidelines for decision rule development:

- If there is an inventory/estimate of remaining materials, media, equipment, floors, walls and ceilings within the building, no inventory/estimates are necessary; otherwise, inventory/estimates are necessary.
- If materials are found to be non-radioactive, non-hazardous, non-beryllium contaminated, non-TSCA and non-ACM, then material can be free-released or managed as sanitary waste.

Radionuclides

The following criteria may be used to determine if Type 2 and 3 facilities contains radionuclide contamination:

- If process knowledge/history supports the premise that no radioactive contamination is present, the related area and/or volume of material is considered sanitary waste or may be free-released.
- If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5 (Radiation Protection of the Public and Environment) and/or are within background concentrations for volume contaminated material, the related area or volume of material is considered sanitary waste or may be free-released.
- If all radiological sample measurements are below the volume contamination thresholds provided in the NRA Program, the related volume of material is considered sanitary waste or may be free released.
- If any radiological survey measurements exceed the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered LLW.
- If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material is considered LLW.
- If any radiological sample measurements exceed 100 nanocuries/gram of plutonium and/or americium for volume contaminated material, the related volume of material is considered TRU waste.

RCRA Constituents

If the waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Part 261. If the waste is free from listed hazardous waste and hazardous characteristics, the waste is considered non-hazardous.

Beryllium

If detectable beryllium contamination can be shown through process knowledge to consist of beryllium powder (P015 under RCRA), then the contaminated materials will be treated as RCRA waste and subject to treatment standards under 40 CFR 268.40, or RFETS will propose release criteria for the material based upon surveys and available information. If beryllium in any form is identified that meets the criteria for an underlying hazardous constituent, it will be subject to Universal Treatment Standards as in 40 CFR 268.48.

If concentrations of beryllium are equal to or greater than 0.2 ug/100 cm^2, the material is considered beryllium contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28, Chronic Beryllium Disease Prevention Program. If the concentrations are below 0.2 ug/100 cm^2, the material is considered non-beryllium contaminated.

PCBs

If material meets the definition of "Bulk Product Waste," it may be disposed of as TSCA waste at a permitted solid waste disposal facility without further characterization (Federal Register, Vol. 63, No. 124, June 29, 1998,40 CFR §761.62,). If the disposal facility does not possess a commercial PCB storage or disposal approval, the generator must provide written notification to the facility in accordance with §762.62.

If material meeting the definition of Bulk Product Waste is to be free-released (e.g., recycled), the 95% upper confidence limit of the mean value of a representative sample set cannot exceed 50 ppm. This determination can be made through process knowledge or laboratory analysis.

If material meets the definition of PCB remediation waste (i.e., potentially containing PCBs form historical releases; §761.61), the free-release concentration is 1 ppm PCBs, as determined in accordance with requirements of §761.61, Subpart G. Higher release levels for PCB remediation wastes are permissible, but carry specific restrictions on disposition of the material.

Asbestos

In accordance with 40 CFR 763 and 5 CCR 1001-10, if any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e., >1% by volume), then material is considered ACM; otherwise the material is considered non-ACM.

5.2.6. Tolerable Limits on Decision Errors

The maximum value for false positive and false negative errors is 5% when calculating the number of samples required for RCRA and TSCA characterization. No statistically based sample sets are required for radionuclides; therefore, decision errors do not apply. Decision error does not apply to asbestos sample sets per 40 CFR 763. Results are compared with the action levels on a sample-by-sample basis.

5.2.7. Optimization of Plan Design

Discretionary radiological surveying and sampling will be conducted on remaining floors, walls, and ceilings as necessary to classify floors, walls and ceiling as non-radioactive waste for PDS purposes. This plan is developed to classify floors, walls and ceilings as non-radioactive waste for PDS purposes. The following criteria can be used to develop the radiological survey/sampling plan:

- Radiological field measurement methods and instrumentation are described in Section 6 of MARSSIM.
- Radiological sampling and preparation for laboratory measurements are described in Section 7 of MARSSIM.
- For materials, media, equipment, floors, walls, and ceilings being released as low level and/or TRU waste, radiological surveys/samples **SHALL** be taken per Site Procedure 1-PRO-079-WGI-001, Waste Characterization, Generation and Packaging.
- If radiological survey/samples are required for materials, media and equipment for release as non-radioactive waste, then radiological surveying and sampling **SHALL** be conducted per the requirement in the RFETS HSP 18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste.
- If RCRA, TSCA or asbestos survey/samples are required for materials, media, equipment, floors, walls and ceilings, refer to Section 6.0.

5.3. DQOs for PDS

The following sections outline the DQO process utilizing the seven steps for PDS characterization.

5.3.1. The Problem

The problems associated with Type 2 and 3 facilities during strip-out involve quantifying the amount of material, media, equipment, floors, walls and ceilings, interior/exterior to the buildings. In addition, the extent of radiological contamination must be adequately characterized so that remaining floors, walls and ceiling can be released as sanitary waste.

5.3.2. The Decision

The decisions associated with Type 2 and 3 facilities during the PDS are determining the inventory/estimate of floors, walls and ceilings within the interior/exterior of building(s) and assessing/collecting sufficient radiological surveys/samples to release all remaining floors, walls and ceilings as sanitary waste.

5.3.3. Inputs to the Decision

The input to the decision for Type 2 and 3 facilities during PDS are the magnitude and location of data from preceding characterizations, including data contained in the RLCR, IM/IRA, DOP and IPC and the identification of applicable action levels, free release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, and WAC.

5.3.4. Decision Boundaries

The decision boundaries include identifying spatial confines of building, including room, sets of rooms or facility in two and three dimensions and temporal aspects of the project.

5.3.5. Decision Rules

The following are decision rules to be used for Type 2 and 3 facilities during PDS:

- If all radiological survey measurements are below the surface contamination thresholds provided in DOE Order 5400.5, the related area or volume of material is considered sanitary waste or may be free-released.
- If all radiological sample measurements are below the volume contamination thresholds provided in the NRA Program, the related volume of material is considered sanitary waste or may be free released.
- If any radiological survey measurement exceeds the surface contamination thresholds provided in DOE Order 5400.5, the related area of material must be dispositioned per Section 5.2 and resurveyed per Section 5.3.
- If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program, the related volume of material must be dispositioned per Section 5.2 and resurveyed per Section 5.3.

5.3.6. Tolerable Limits on Decision Error

The maximum value for false positive and false negative errors is 5% when calculating the number of samples required.

5.3.7. Optimization of Plan Design

Statistically based radiological surveying and sampling **SHALL** be conducted per the requirements in Section 5.5 of MARSSIM and the PDSP. The location of radiological survey/sampling points **SHALL** be delineated per the requirements in Section 5.5 of MARSSIM. Radiological field measurement methods and instrumentation **SHALL** be delineated per the requirements in Section 6 of MARSSIM. Radiological sampling and preparation for laboratory measurements **SHALL** be delineated per the requirements in Section 7 of MARSSIM.

5.4. DOCUMENTATION REQUIREMENTS

Two of the three characterization phases for Type 2 and Type 3 facilities require an RLCR and an PDSR. No formal plan is required for IPC. Applicable IPC results are documented in the PDSR.

5.4.1. RLCR

The documentation of RLC results is a RFCA-mandated report. This report **SHALL** provide an analysis of the characterization results and summarize the hazards and risks associated with the facility, including the nature and extent of radiological and chemical contamination and the types and volumes of wastes to be managed. Compliance with data quality and review requirements **SHALL** also be documented, as described in Section 7. The report should provide information in adequate detail to allow DOE to make a determination if the facility has significant contamination or hazards, as described in Attachment 9 of the RFCA. DOE will use the information from the report to confirm its categorization of the facility, and will transmit the report and a notification letter to the Lead Regulatory Agency for concurrence. The notification letter will include DOE's determination as to the facility type. Refer to Section 3.4.4 of the DPP for more detail on the process. **An outline for the RLCR is presented in Appendix C.**

Final reports containing survey/sample results **SHALL** describe the results of QC measurements, audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data (including field and confirmatory data) and data storage **SHALL** be documented with the corrective actions taken to correct the deficiencies identified (pursuant to K-H Analytical Services Division QA documentation). Section 7.0 discusses the data review requirements.

5.4.2. PDSR

The documentation of PDS results is an RFCA-mandated report. This report **SHALL** provide data on the nature and extent of radiological and chemical contamination after strip-out and decontamination. Compliance with data quality and review requirements **SHALL** be documented, as described in Section 7. This report **SHALL** validate that the building may be free-released as sanitary waste or material for recycle, and **SHALL** indicate if and where any residual contamination remains. **An outline for the Pre-Demolition Survey Report is presented in Appendix C.**

Final reports containing survey results should describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage **SHALL** be documented with the corrective actions that have been taken to correct the deficiencies identified. Refer to Section 7.0, which discusses data review requirements.

6.0 SAMPLING AND ANALYSIS

The DQO process will identify sampling and analysis needs. For example, if historical data or process knowledge is not available to make a D&D decision, sampling and analysis **SHALL** be required. This section describes the minimum sampling requirements for the non-radioactive COC, and the methods required to determine chemistry of the samples. These methods **SHALL** be implemented following determination of the project-specific DQOs. This section does not address radiological swipes and sampling, radiological field measurement methods and instrumentation, and radiological sampling and preparation for laboratory measurement (refer to MARISSIM Sections 5.0, 6.0, and 7.0, and the RLCP and PDSP).

If process or historical knowledge suggests that a medium is contaminated and the project assumes the associated risk of false positive results, the medium may be categorized as contaminated without further sampling prior to remedial actions. This rationale allows potential cost-savings relative to sampling and analysis, but has the associated risk of excess costs from managing hazardous/radioactive waste (when the waste is actually non-hazardous and non-radioactive). Confidence in such a decision resides in the quality of the process and/or historical knowledge, and consideration of the waste minimization requirements contained in 6 CCR 1007-3 and DOE Order 5820.2A.

Samples **SHALL** be collected and submitted for analysis in bulk form pursuant to applicable regulations. For example, samples of paints from walls constructed with cinder blocks should contain both the superficial paint layer(s) and a portion of the associated cinder block wall. Also, a minimum of 100 and maximum of 200 grams (g) of bulk sample is required for performance of the Toxicity Characteristic Leaching Procedure (TCLP).

6.1. Asbestos

Three categories of materials, potentially containing asbestos, **SHALL** be sampled for asbestos, per 40 CFR 763.86 and 5 CCR 1001-10, by a Certified Asbestos Inspector:

- Thermal systems (e.g., pipe insulation);
- Surfacing materials (e.g., fireproofing, ceiling texture); and
- Miscellaneous material (e.g., floor tiles, ceiling panels)

<u>Thermal systems:</u> Requirements include three samples per homogeneous area; one per patched area less than six linear or square feet; and at least one for mudded, cemented or plastered fittings.

<u>Surfacing materials:</u> A minimum of three samples are required per homogeneous areas less than 1,000 ft^2 in dimension. Five samples are required per homogeneous areas

between 1,000 ft^2 and 5,000 ft^2. Where homogeneous areas of greater than 5,000 ft^2 are encountered, seven samples are required. Samples are randomly selected from the centers of a square grid proportional to the size of the area. Grid spacing is only required for friable surfacing materials which may include drywall joint compound if suspected by the inspector.

Miscellaneous material: At least one sample is required per homogeneous area.

The presence of asbestos (i.e., > 1% by volume) **SHALL** be determined at a laboratory with asbestos accreditation (NIST and NVLAP). The acceptable asbestos characterization method is EPA 600/R-93/116. Based on the sampling results and the bulk materials represented by the samples, the quantities of friable and non-friable ACM **SHALL** be estimated for subsequent abatement and waste management purposes.

6.2. Polychlorinated Biphenyls (PCBs)

Material/media potentially contaminated with PCBs **SHALL** categorized as either PCB Bulk Product Waste or PCB Remediation Waste. Where doubt exists as to the classification of a type of PCB-containing material, 40 CFR 761 **SHALL** be consulted directly.

For non-porous surfaces, wipe sampling of a sampling area of 100 cm^2 **SHALL** be performed out utilizing a gauze pad or filter paper moistened with a suitable solvent (generally hexane). For porous surfaces, coring **SHALL** be used as described in EPA-560/5/86-017.

To assess material/media against the appropriate regulatory threshold for PCB-contaminated media (40-CFR 761.125), the SW-846 analytical method 4020 ("Screening for PCBs by Immunoassay") is appropriate for non-aqueous liquids (or solids), whereas method 8082 ("CBs by Gas Chromatography" is recommended under other circumstances.

The analytical method **SHALL** have a practical quantitation limit (PQL) of less than 50% of the regulatory threshold that applies to the particular type of waste. Methods 4020 and 8082 satisfy this criterion.

PCB Bulk Product Waste

Materials classified as PCB Bulk Product Waste need not be sampled as long as restrictions outlined in 40 CFR 761.62 regarding their disposal are met. These materials include but are not limited to applied dried paints, coatings, and sealants and fluorescent light ballasts.

PCB Remediation Waste

Buildings where PCB use occurred, but for which there are adequate inspection records, operational records, and administrative records to show that no PCB spill has occurred, or if such did occur, was cleaned up to meet standards in 40 CFR 761 through 766, need not be sampled.

However, where PCB use occurred and above-mentioned records do not exist, a small-scale survey **SHALL** be performed, with three judgement samples plus a duplicate taken at locations biased toward probable contamination areas. If such surveys indicate PCB contamination, or if a PCB spill is discovered that has not been cleaned up, the area will be treated as directed by the most recent versions of 40 CFR 761 through 766, the RFETS PCB Program Management Plan, and the WSRIC standards.

Sampling of the area to determine whether it meets the criteria of **PCB remediation waste** will include application of the Midwest Research Institute grid procedure described in "Verification of PCB Spill Cleanup by Sampling and Analysis")EPA-560/5-85-026) and "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup" (EPA-560/586/017).

Other PCB Wastes

While less likely to be encountered during RLC, other classes of PCB waste, including PCB items, PCB liquids, and PCB/radioactive waste, will be sampled according to applicable sections of 40 CFR 760 through 766.

6.3. RCRA CONSTITUENTS

Media potentially contaminated with RCRA constituents **SHALL** be characterized using process knowledge and/or analyzed for compounds and elements in accordance with 6 CCR 1007-3, Part 261, and 40 CFR 268. Analytical methods **SHALL** have PQLs at levels better than 50% of the regulatory thresholds. The following SW-846 methods or equivalent industry-proven methods **SHALL** be used for analyses or other equivalent methods as specified in the applicable WAC:

- Metals (incl. Be) 6010B
- Mercury 7470A (liquid) or 7471A (solid)
- Semivolatiles 8270C
- Volatiles 8260B
- Pesticides 8081A
- Herbicides 8151A
- Ignitability 1010 or 1020A (liquid) or 1030 (solid)
- Corrosivity 1110 or 1120
- Reactivity HCN Test Method or H_2S Test Method

Both total analysis and the TCLP can be used to characterize solid samples. If total analysis is used, results **SHALL** be divided by 20 before comparison with Table 6-1. If TCLP is used, the SW-1311 preparation method **SHALL** be used. The Paint Filter Test, SW-9095A, **SHALL** be used for sludge for determining whether liquid or solid units shall be reported.

All samples from painted surfaces (non-asbestos samples) acquired for lab analysis **SHALL** be acquired by ASTM Method E 1729-95, Standard Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques.

Table 6-1 Maximum Concentration of Contaminants for the Toxicity Characteristic

EPA HW No. \1\	Contaminant	CAS No. \2\	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon Tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	\4\ 200.0
D024	m-Cresol	108-39-4	\4\ 200.0
D025	p-Cresol	106-44-5	\4\ 200.0
D026	Cresol		\4\ 200.0
D016	2,4-D	94-75-7	10.0
D027	1, 4-Dichlorobenzene	106-46-7	7.5
D028	1, 2-Dichloroethane	107-06-2	0.5
D029	1, 1-Dichloroethylene	75-35-4	0.7
D030	2, 4-Dinitrotoluene	121-14-2	\3\ 0.13
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	\3\ 0.13
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	\3\ 5.0
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2, 4, 5-Trichlorophenol	95-95-4	400.0
D042	2, 4, 6-Trichlorophenol	88-06-2	2.0
D017	2, 4, 5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	0.2

\1\ Hazardous waste number.
\2\ Chemical Abstracts Service (CAS) number.
\3\ Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore Becomes the regulatory level.
\4\ If -, m- and p-Cresol concentrations cannot be differentiated, the total cresol (D-026) concentration is used. The regulatory level of total cresol is 200 mg/l.

SOURCE: 6 CCR 1007-3, Part 261, and 40 CFR 268

7.0 QUALITY ASSURANCE AND DATA REVIEW

D&D characterization activities **SHALL** meet quality assurance (QA) requirements contained in the Site Quality Assurance Program. The Site QA Program indicates how the quality assurance criteria of 10 CFR 830.120 and DOE Order 5700.6C are to be implemented. The Quality Assurance Program Infrastructure Document List lists the Quality Assurance Program infrastructure implementing documents, and the Quality Assurance Program Criteria specifies the detailed requirements from regulations and adopted industry standards. A key standard contained in the Quality Assurance Program Criteria includes Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, ANSI/ASQC E4-1994. This standard is a national consensus, management system standard for ensuring data quality, and is directly applicable to D&D characterization. All management systems used in acquiring data **SHALL** conform to this standard.

7.1. QUALITY ASSURANCE

Key QA criteria that apply to all phases of D&D characterization include Personnel Training and Qualification, Work Processes, and Documents and Records. Compliance with these criteria is discussed below. Details on implementing QA requirements associated with surveys, sampling and analysis records, including quality control, are presented in the RLCP and the PDSP.

7.1.1. Personnel Training & Qualification

Personnel **SHALL** be qualified to perform their respective tasks based on a combination of education, training, and experience. The K-H training and qualification program is administered through the use of the K-H Training User's Manual (1-10000-TUM), the Training Implementation Matrix, and the Training and Scheduling Records database. These processes are designed to ensure that qualifications and training are maintained current for all individual work assignments. Education and professional experience **SHALL** constitute the primary means of qualification for activities that emphasize problem-solving strategies, where creativity and innovation are essential components of optimizing the activity or item. Conversely, training **SHALL** be the primary means of qualification where consistency and team coordination constitutes a major component of the overall quality (or safety) of the process or item, and the process is well established, proven, and perfunctory.

Training and qualification requirements applicable to K-H, Principal Subcontractors, and lower-tier subcontractors are presented in the K-H Training User's Manual. Training requirements specific to a project can be given in a health and safety plan, a list of qualified individuals (LOQI), or a training implementation plan. In addition, a project-specific QA briefing **SHALL** be given during the pre-evolution briefing prior to project start-up in the field, and to new personnel prior to their participation on the project. A

QA briefing **SHALL** cover the QA requirements, and the briefing documented **SHALL** be through the pre-evolution attendance roster.

7.1.2. Work Processes

All work **SHALL** be performed to established technical standards and administrative controls using approved instructions, procedures, or other appropriate means. Individual workers are responsible for the quality of their work. Management **SHALL** provide the workforce with the tools, materials, and resources (including training) necessary for successful accomplishment of their assigned tasks. Performance criteria for personnel **SHALL** be established and clearly communicated to the individuals. Work is controlled by subcontractor documents and the following K-H documents:

- Configuration Change Control Program
- Integrated Work Control Program Manual (MAN-071-IWCP)
- Conduct of Operations Manual (Man-066-COOP)
- Site Documents Requirements Manual (1-MAN-013-SDRM)
- Integrated Safety Management System Manual (1-MAN-016-ISM)
- Radiological Control Manual
- Radiological Safety Practices Manual
- Health and Safety Practices Manual
- Radiation Protection Program Procedure (1-Q50-RPP-0001)

7.1.3. Documents and Records

Work-controlling documents, such as work plans (including IWCP work packages), standard operating procedures, and health and safety plans, **SHALL** be controlled in accordance with the Site Documents Requirements Manual, where "control" is constituted by the following criteria:

- Documents are uniquely identified for reference purposes;
- Required reviews and approvals are accomplished; and
- Personnel, who need the documents to perform work, receive the latest approved versions of the document(s) prior to implementation.

The document control process is described in procedure MAN-063-DC, Document Control Program Manual. Essential policies, plans, procedures, decisions, data, and transactions of the project **SHALL** be documented to an appropriate level of detail.

Quality records, including digital data stored on computerized media, **SHALL** be managed to ensure that information is retained, retrievable, and legible. Active records **SHALL** be maintained by project personnel, including subcontractors, in an organized and retrievable fashion until such time that the records have served their purpose and become inactive. Quality records are considered active until the final peer reviews are conducted; therefore, quality records are not subject to the 30-day limit on turnover to the Records Center until final peer reviews are conducted. Peer reviews of records **SHALL** be conducted on records completed by the originator within two (2) weeks of completion. Records at the job-site **SHALL** be stored and protected in fire-safe boxes. Quality records managed by contractors and subcontractors **SHALL** be transferred and archived in accordance with 1-B41-RM-001, Records Management Guidance for Records Sources.

Quality records resulting from direct measurements or technical sampling activities **SHALL** be authenticated by the originator and subsequently authenticated by a peer reviewer. For data uploaded to computer from quality records described above, final data entry (as portrayed on hardcopy output) **SHALL** be reviewed by someone other than the data entry person, and the hardcopy **SHALL** be authenticated by the reviewer. Errors on quality records **SHALL** be corrected by striking through the original entry with a line, and incorporation of the correct data adjacent to the strike-out. Authentication is also required for corrections.

Documents and records that are part of the CERCLA Administrative Record are defined in 1-F78-ER-ARP, CERCLA Administrative Records Program. This procedure describes how such documents and reviews shall be dispositioned.

K-H Analytical Services Division (ASD) is responsible for all original records produced concerning lab-generated chemistry and radiochemistry data. The projects **SHALL** use data as provided by ASD or their subcontractors. The K-H Correspondence Control Program is presented in Procedure 1-L43-IMS-001. Document and records requirements are also presented in subcontractor documents.

7.2. DATA REVIEWS

Data collected during characterization **SHALL** be reviewed prior to incorporation into final reports to determine usability and compliance with RFCA and minimum quality requirements. In general, reviews include data verification and validation (V&V); precision, accuracy, representativeness, completeness and comparability (PARCC) evaluations; and Data Quality Assessment (DQA). Radiological data collected during the reconnaissance level and in-process phase **SHALL** be reviewed according to the Radiological Control Manual and established Radiological Safety Practices Procedures. Radiological data gathered during surveys **SHALL** be reviewed according to MARSSIM.

7.2.1. DATA VERIFICATION AND VALIDATION (V&V)

Verification **SHALL** be performed on sets of data produced by the project on which decisions are based. Validation **SHALL** be performed on minimum percentages of data/data packages as stipulated in project-specific sampling and analysis plans.

Analytical data **SHALL** be verified and validated according to RFETS Analytical Services Division guidelines (General Guidelines for Data Verification and Validation, DA-GR01-V1).

Project managers **SHALL** plan for V&V accordingly by ensuring adequate funding, schedule, and personnel to achieve data quality requirements as the project progresses. Comprehensive V&V immediately prior to final reporting is typically too late to allow for data disparity corrective actions. Budgeting is typically based on the estimated number of samples/analyses planned for the project, and is some percentage of the analysis cost.

Data verification ensures that the requirements stated in characterization plans were implemented as prescribed in project-specific sampling and analysis plans. For example, verification ensures that requirements relative to the data produced by the project are satisfactory with respect to quantity, types, and format of data specified in the applicable planning documents and data packages. The attached checklist (Table 7-1) identifies the type of D&D verification that **SHALL** be performed. Additional line items **SHALL** be incorporated on a project-by-project basis, relative to project-specific data requirements and those requirements identified by the Analytical Services Division. In addition, every D&D report **SHALL** assess the entire data set used for decisions as defined in the DQO section. The attached data becomes a critical part of the CERCLA Administrative Record, which further verifies the D&D measurements of interest. A section of the report **SHALL** explain the steps and criteria used for data verification and validation, including qualified and rejected data, and a summary table of all methods used, real samples, and QC samples. All data **SHALL** be verified.

In contrast to data verification, data validation is an in-depth technical review of the data that determines whether characterization was performed within quality control requirements and tolerances. Depending on the project and the critical nature of samples, a percentage of the entire data may be validated, so long as the percentage is representative. For example, validation percentages **SHALL** include the following:

- Results from all laboratories used during the project;
- Results from samples collected by each subcontractor and/or representative of each of the project subcontractor's work;
- Results from each medium sampled; and
- Results from each analytical method used.

A validation rate of greater than or equal to 25% is currently used at the RFETS, based on acceptance through approved work plans by EPA Region VIII and CDPHE. A lower validation rate may become acceptable to the agencies; however, depending on the number of critical samples or surveys for a given project, higher frequencies of validation may be desired for higher confidence. MARSSIM Appendix N also provides guidance for data validation.

Table 7-1 Data Verification Checklist

	Caveat?	*Compliance? Yes*	*No*
1. DATA PACKAGE & SAMPLE RESULTS			
a) Package(s) is intact and meets project-specific requirements (hard-copy and electronic data deliverable [EDD])			
b) Chain-of-Custody forms were completed and authenticated; all original sample IDs are traceable to final results			
c) Sample turnaround, holding times, & preservation requirements were met			
d) Specified parameters were captured per DQOs			
e) Results reported for each requested analyte/radionuclide			
f) Results with appropriate significant figures			
g) Final results are traceable to locations			
2. QC SAMPLE RESULTS SUMMARY			
a) Sensitivity of methods adequate (i.e., practical quantitation limits $\leq$ 50% action levels			
b) PARCC parameters achieved relative to project-specific DQOs			

Respond to each checklist item in the "Caveat?" column with a footnote as applicable and provide the caveat in the Footnotes section below.

FOOTNOTES:

I certify that all responses to this checklist accurately reflect the completeness and quality aspects of this sample data package. Furthermore, I understand that inaccuracies in the completion of this checklist will be considered a nonconformance to Subcontract Requirements as evidenced by the following signature of the laboratory manager or designee.

Print/Typed Name: ______________________________ Title: ________________________

Signature ____________________________________ Date ________________________

7.2.2. PARCC EVALUATIONS

Following V&V, the data set **SHALL** be evaluated relative to the PARCC parameters. PARCC parameters **SHALL** be assessed and summarized to ensure compliance with minimum quality requirements, and communication of compliance and any exceptions to the regulators and stakeholders.

7.2.2.1. Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The laboratory control sample duplicates (LCSD) **SHALL** be used to determine the precision of the analytical method, and blind field duplicates **SHALL** to evaluate overall project precision. Overall project precision is the measurement of the variability associated with the entire sampling and analysis process within the project. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples **SHALL** be analyzed to assess overall project and laboratory precision, respectively. The precision measurements **SHALL** be determined using the relative percent difference (RPD) between the sample results, or the duplicate error ratio (DER). RPD values are determined for non-radiological measurements, and DER values are used for radiochemistry measurements.

DER values, in contrast to strictly deterministic relative percent differences in measurements, consider uncertainty associated with both measurements, as well as the single reported values. Such a comparison is statistical in nature, and has associated statistical confidence built into the comparison that is chosen by the decision-maker (e.g., comparison with a selected z-score that corresponds to a 95% confidence). Other controls that define the precision include control or tolerance charting (daily minimum) at a plus or minus threshold for radiological surveys.

7.2.2.2. Accuracy

Accuracy is a measurement of how closely the measured value corresponds to the true value, and includes components of random uncertainty and systemic error. Therefore, accuracy reflects the total uncertainty associated with a measurement. Analytical accuracy **SHALL** be measured by comparing the percent recovery of analytes (spiked into a laboratory control sample duplicate) to a control limit. For volatile and semivolatile organic compounds, surrogate compound recoveries **SHALL** also be used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples **SHALL** also be used to ensure quality control for atypical contaminants or radionuclides of concern, or when interference is an issue.

Accuracy **SHALL** be calculated and qualified for each D&D QA sample batch, and the associated sample results **SHALL** be interpreted by considering these specific measurements and other qualitative considerations. Measurement uncertainties, both quantitative and qualitative, **SHALL** be reported for all data-sets used in decision-making (see MARSSIM, Section 6.8).

7.2.2.3. Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness **SHALL** be achieved through use of the standard field, sampling, and analytical procedures. Representativeness **SHALL** also be determined by appropriate program design, with consideration of elements such as sample locations, matrix and sample type.

7.2.2.4. Completeness

Completeness **SHALL** be calculated and reported for each method, matrix and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, **SHALL** determine the completeness of the data set. For completeness requirements, valid results **SHALL** be all results not rejected due to inadequate quality control. The percentage requirements for completeness **SHALL** be 100 percent for regulatory compliance and project-specific relative to the particular DQOs (>90% is typical). For any instances of samples that could not be analyzed for any reason (e.g., holding time violations in which re-sampling and analysis were not possible, samples spilled or broken, etc.), the numerator of the calculation **SHALL** become the number of valid results minus the number of possible results not reported. The formula for calculation of completeness is presented below.

$$\%\ \text{completeness} = \frac{\text{number of valid results}}{\text{number of possible results}} \times 100$$

Where absolute regulatory requirements for sample set completeness are undefined, statistical methods for evaluating completeness of data sets **SHALL** be applied, such as those methods described in MARSSIM (Section 9), EPA G-4 and G-9. These methods include use of :

- Power curves relative to hypothesis testing;
- Analysis of means and variabilities relative to regulatory action levels;
- Evaluation of outliers and dispersion;
- Transformations; and
- Tests on distributional assumptions.

If other scientifically recognized methods for evaluating sample sets are implemented, the methods and results **SHALL** be included in the corresponding final report.

7.2.2.5. Comparability

Comparability is the confidence with which one data set can be compared to another data set. One of the objectives of characterization is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability **SHALL** be achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms **SHALL** support the assessment of comparability. Analysis of PE samples and reports from audits **SHALL** also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability **SHALL** be achieved through consistent use of methods and documentation procedures throughout the project.

7.2.3. DATA QUALITY ASSESSMENT (DQA)

DQA is a scientific and statistical evaluation that determines if the data are of the right type, quality, and quantity to support their intended use, which in this case, is to make decisions regarding D&D. The decisions and the decision-rules are defined within the DQO framework. Although some data assessment may be performed before or in-parallel with data V&V (i.e., confirmation), the DQA **SHALL** not be final until V&V are complete. This restriction is necessary since the data assessment assumes that the individual data constituting statistics and parameters are satisfactory for their intended purpose and based on quality requirements. Data quality is not assumed, but measured.

The DQA process, as defined by EPA QA/G-9 (EPA, 1996) and MARSSIM (NUREG-1575) constitutes the guidance for assessing the quality of data. MARSSIM addresses DQA in Section 8.0 and more specifically in Table 2.3 and Appendices E & I. The assessment **SHALL** include evaluating sample quantities, and sources and magnitudes of uncertainty relative to tolerances allowed in planning documentation (e.g., the RLCP and the PDSP), including both systematic and random sources of error. The G-9 process consists of the following five steps:

1. Review DQOs;
2. Conduct preliminary data review;
3. Select statistical test;
4. Verify assumptions of the statistical test; and
5. Draw conclusions from the data.

8.0 REFERENCES

EPA, 1994. U.S. Environmental Protection Agency. Guidance for the Data Quality Objectives Process, QA/G-4, September 1994 (EPA/600/R-96/055).

DOE, 1992. U.S. Department of Energy. Manual for Conducting Radiological Surveys in Support of License Termination, June 1992 (DOE/EMO142P).

DOE, 1995. U.S. Department of Energy. Decommissioning Resource Handbook, (DOE/EM), August 1995.

EPA, 1986. U.S. Environmental Protection Agency. Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup, (EPA-560/5-86-017).

DOE/RFFO, CDPHE, EPA. Final Rocky Flats Cleanup Agreement (RFCA), July 19, 1996.

Department of Defense, Department of Energy and Nuclear Regulatory Commission. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), December 1997 (NUREG 1575, EPA 402-R-97-016).

EG&G Rocky Flats, 1993. No-Radioactivity-Added (NRA) Waste Verification Program, September 1993.

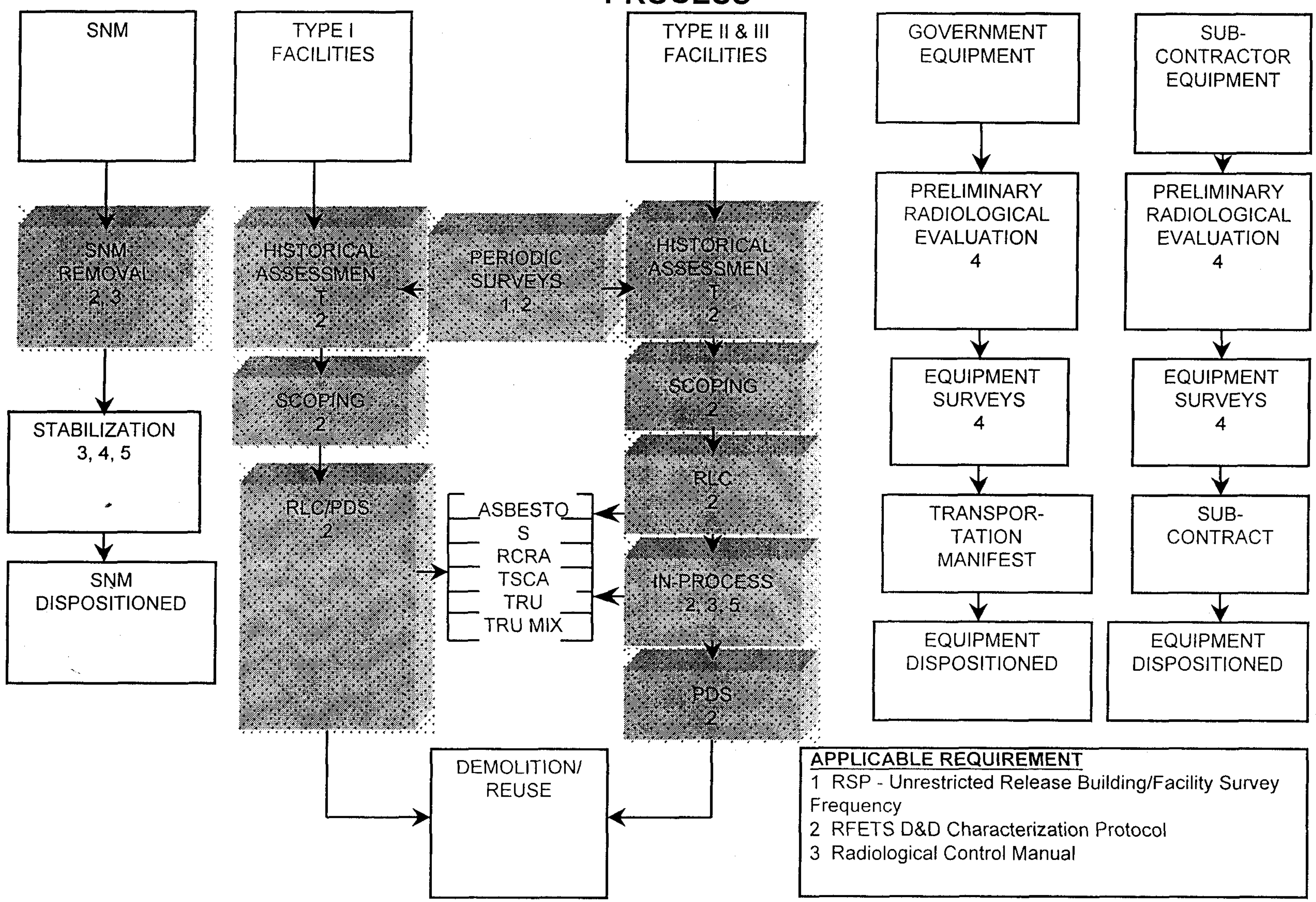
DOE, 1996. U.S. Department of Energy. Statistical and Cost Benefit Enhancements for the DQO Process for Characterization Decisions, September 12, 1996 (DOE/EM-0316)

9.0 Appendices

Appendix A

The RFETS Characterization Process

THE RFETS CHARACTERIZATION PROCESS



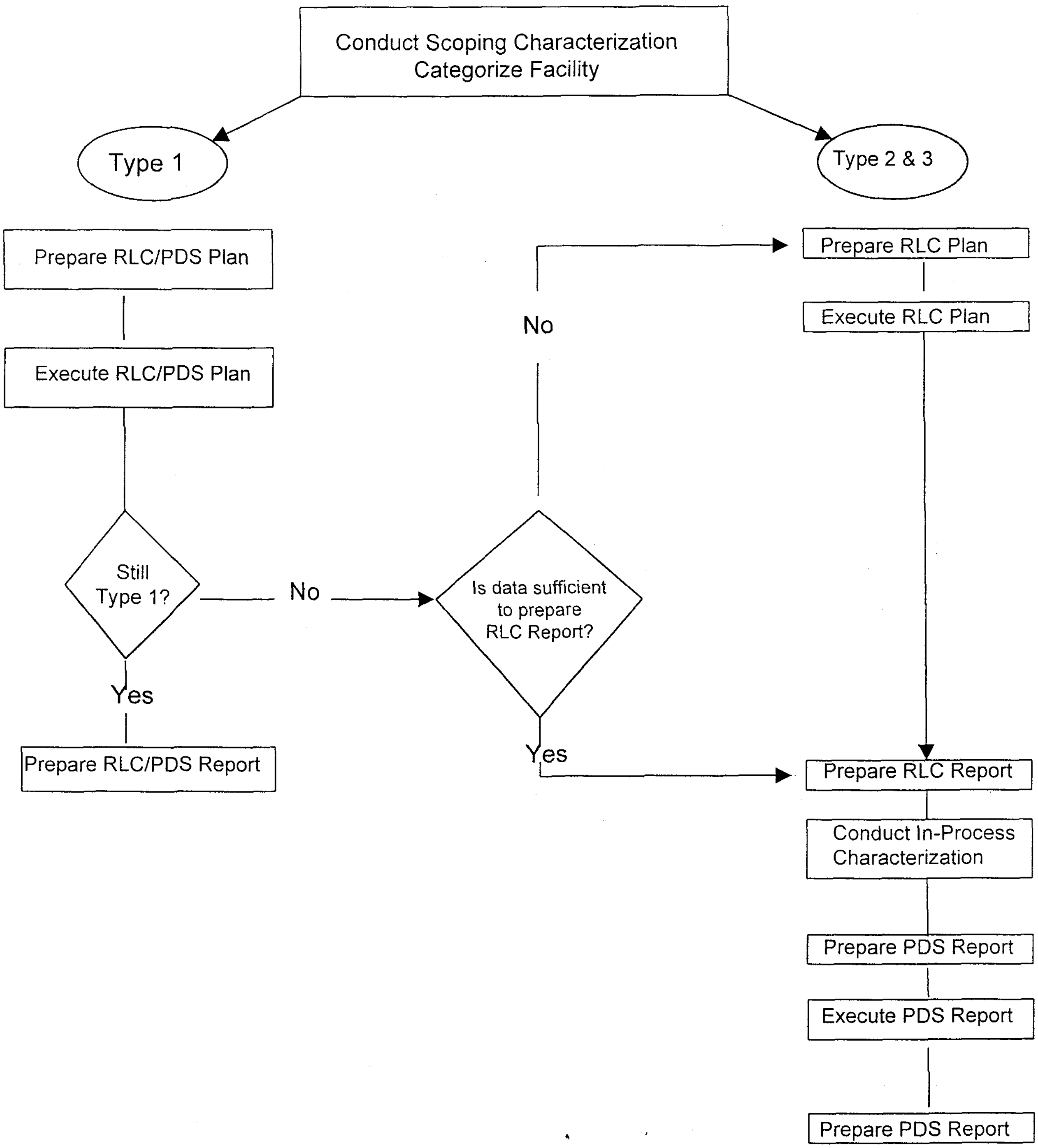
DRAFT

05/05/99
1:06 PM

Best Available Copy

Appendix B

The D&D Characterization Process logic Diagram


Conduct Scoping Characterization
Categorize Facility
Type 1
Type 2 & 3
Prepare RLC/PDS Plan
Execute RLC/PDS Plan
Still
Type 1?
No
Yes
Prepare RLC/PDS Report
Is data sufficient
to prepare
RLC Report?
No
Yes
Prepare RLC Plan
Execute RLC Plan
Prepare RLC Report
Conduct In-Process
Characterization
Prepare PDS Report
Execute PDS Report
Prepare PDS Report

Appendix C

Outlines of Characterization Reports

RECONNAISSANCE-LEVEL CHARACTERIZATION REPORT

EXECUTIVE SUMMARY

INTRODUCTION

- Report Purpose
- Characterization/Survey Scope
- Report Content

SUMMARY OF CHARACTERIZATION/SURVEY ACTIVITIES

- Data Quality Objectives Used
- Summary of Previously Collected Data
- Summary of RLC Data Collected (e.g., number of samples, sample locations, sample and survey grids)
- Sampling and Field Measurement/Surveying Methods, Procedures and Equipment
- Laboratory Analysis

BUILDING / CLUSTER OPERATING HISTORY

- History of Buildings (Results of Historical Site Assessment)
  - Include Releases and Fires
- Current Operations
- RCRA and CERCLA Designated Areas

PHYSICAL DESCRIPTION

- Summary Description
- Specific Descriptions
  - Foundations
  - Structural Framing
  - Exterior Walls
  - Floors
  - Interior Walls
  - Ceilings
  - Doors
  - Windows
  - Surface Finishes
  - Stacks and Vents
  - Utilities, including electrical, potable water, fire water, gas, etc.
  - Process and Waste Lines, including industrial and sanitary systems

IDENTIFIED BUILDING HAZARDS

- Physical
- Radiological

- Chemical
  - Lead
  - Beryllium
  - Other Metals
  - PCBs
  - Chlorinated Solvents
  - Other Organics
  - Others
- Asbestos
- Pressurized Gas and Liquid Nitrogen
- Electrical
- Wastes
  - Hazardous Waste
  - LLW and LLMW
  - TRU and TRU Mixed Waste
  - Asbestos Waste
  - PCB Waste
  - Non-Rad / Non-Haz
- Other

DECOMMISSIONING WASTE TYPES AND VOLUME ESTIMATES

DATA QUALITY ASSESSMENT

ANALYSIS AND INTERPRETATION OF RESULTS

- Indicate facility classification (Type I, II or III)
- Discuss results in terms of decision rules and final disposition
- Discuss any decision limitations

REFERENCES

APPENDICES

PRE-DEMOLITION SURVEY REPORT

EXECUTIVE SUMMARY

INTRODUCTION
Report Purpose
Survey Scope
Report Content

SUMMARY OF CHARACTERIZATION ACTIVITIES
Data Quality Objectives Used
Data Collected
Sampling and Field Measurement/Surveying Methods, Equipment and Procedures
Laboratory Analysis

BUILDING / CLUSTER HISTORY AND DESCRIPTION
Radiological Description
Chemical Description

DECOMMISSIONING WASTE TYPES AND VOLUME ESTIMATES

DATA QUALITY ASSESSMENT

ANALYSIS AND INTERPRETATION OF RESULTS
Discuss results in terms of decision rules and final disposition
Discuss any decision limitations

REFERENCES

APPENDICES

RECONNAISSANCE-LEVEL CHARACTERIZATION/PRE-DEMOLITION SURVEY REPORT

EXECUTIVE SUMMARY

INTRODUCTION
- Report Purpose
- Characterization Scope
- Report Content

SUMMARY OF CHARACTERIZATION ACTIVITIES
- Data Quality Objectives Used (including the Problem and Decisions)
- Summary of Previously Collected Data
- Summary of RLC/PDS Data Collected
- Sampling and Field Measurement Methods, Procedures and Equipment
- Laboratory Analysis

BUILDING / CLUSTER OPERATING HISTORY
- History of Buildings (results of Historical Site Assessment)
  - Include Releases and Fires
- Current Operations
- RCRA and CERCLA Designated Areas

PHYSICAL DESCRIPTION
- Summary Description
- Specific Descriptions
  - Foundations
  - Structural Framing
  - Exterior Walls
  - Floors
  - Interior Walls
  - Ceilings
  - Doors
  - Windows
  - Surface Finishes
  - Stacks and Vents
  - Utilities, including electrical, potable water, fire water, gas, etc.
  - Process and Waste Lines, including industrial and sanitary systems

IDENTIFIED BUILDING HAZARDS
- Physical
- Radiological
- Chemical

- Lead
- Beryllium
- Other Metals
- PCBs
- Chlorinated Solvents
- Other Organics
- Others

Asbestos
Pressurized Gas and Liquid Nitrogen
Electrical
Wastes

- Hazardous Waste
- LLW and LLMW
- TRU and TRU Mixed Waste
- Asbestos Waste
- PCB Waste
- Non-Rad / Non-Haz

Other

DECOMMISSIONING WASTE TYPES AND VOLUME ESTIMATES

DATA CONFIRMATION AND DATA QUALITY ASSESSMENT

FINAL BUILDING/CLUSTER CATEGORIZATION (TYPE) AND NEXT STEPS IN THE DECOMMISSIONING PROCESS

Discuss building categorization based on characterization/survey results in terms of the DQO "problem" and "Decisions".

Appendix D

Reconnaissance Level Characterization Plan

DRAFT DRAFT DRAFT

Rocky Flats Environmental Technology Site

RECONNAISSANCE LEVEL CHARACTERIZATION PLAN FOR D&D FACILITIES

REVISION 0

62

Table of Contents

64

ABBREVIATIONS/ACRONYMS

ACM	Asbestos-containing material
AHA	Activity Hazard Analyses
AHERA	Asbestos Hazard Emergency Response Association
AIHA	American Industrial Hygiene Association
ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing Materials
Be	Beryllium
CBDPP	Chronic Beryllium Disease Prevention Program
CCR	Code of Colorado Regulations
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
COC	Contaminants Of Concern
CPM	Counts Per Minute
D&D	Decommissioning and Decontamination
DAC	Derived Air Concentration
$DCGL_W$	Derived Concentration Guideline Level – Wilcoxon Rank Sum Test
$DCGL_{EMC}$	Derived Concentration Guideline Level – elevated measurement comparison
DER	Duplicate Error Ratio
DOE	U.S. Department of Energy
DPM	Disintegration Per Minute
DPP	Decommissioning Program Plan
DQA	Data Quality Assessment
DQO	Data Quality Objectives
ER	Environmental Restoration
EPA	U.S. Environmental Protection Agency
FDPM	Facility Disposition Program Manual
HCA	High Contamination Area
HEUN	Highly Enriched Uranyl Nitrate
HRR	Historical Release Report
HSA	Historical Site Assessment
HSP	Health and Safety Plan
HVAC	Heating, Ventilation, and Air Conditioning
ICRP	International Commission on Radiological Protection
IH	Industrial Hygiene
IMC	Integrated Management Contractor
IPC	In-Process Characterization
IWCP	Integrated Work Control Package
K-H	Kaiser-Hill Company, L.L.C.
JHA	Job Hazard Analysis

ABBREVIATIONS/ACRONYMS (cont'd)

LCS	Lab Control Samples/Spikes
LAB	Local Area Background
LKBA	Location of Known Beryllium Areas
LLMW	Low-Level Mixed Waste
LLW	Low-level Waste
LOQI	List of qualified Individuals
M&TE	Measuring and Test Equipment
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCE	Mixed Cellulose Ester
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Concentration Rates
mg/L	Milligram/Liter
MS	Matrix Spikes
NIST	National Institute of Standards and Technology
NORM	Naturally Occurring Radioactive Material
NRA	No Radiation Added
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PATS	Plant Action Tracking System
PCBs	Polychlorinated Biphenyl's
PDS	Pre-Demolition Survey
PDSP	Pre-Demolition Survey Plan
PDSR	Pre-Demolition Survey Report
PID/FID	Photo Ionization Detector/Flame Ionization Detector
ppb	Parts per Billion
PPE	Personal Protective Equipment
ppm	Parts per Million
Pu	Plutonium
PLM	Polarized Light Microsopy
PQL	Practical Quantitation Limit
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAP	Quality Assurance Program
QC	Quality Control
RBE	Radiological Building Engineers
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
RIRs	Radiological Improvement Reports
RLC	Reconnaissance Level Characterization
RLCP	Reconnaissance Level Characterization Plan
RLCR	Reconnaissance Level Characterization Report

ABBREVIATIONS/ACRONYMS (cont'd)

RPD	Relative Percent Difference
RSC	Removable Surface Contamination
RSD	Relative Standard Deviation
RSP	Radiological Safety Practice
SME	Subject Matter Expert
SCM	Surface Contamination Monitors
SOW	Statement of Work
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TRU	Transuranic
TSC	Total Surface Contamination
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Level
U	Uranium
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WGP	Weapons Grade Plutonium
WSRIC	Waste Stream Residue Identification and Characterization

1.0 INTRODUCTION

Reconnaissance Level Characterization (RLC) is a critical phase of building decontamination and decommissioning (D&D), as described in the Rocky Flats Environmental Technology Site (RFETS) *Facility Disposition Program Manual (FDPM)* and the RFETS *Decontamination and Decommissioning Characterization Protocol (K-H, 1999a).*

The objective of RLC is to provide an overall assessment of the contamination, hazards, and other conditions associated with a building cluster. Such an assessment will enable project personnel to make disposition decisions, identify D&D approaches and technologies, develop worker health and safety controls, estimate waste volumes by waste types, prepare sound decision documents for agency review and approval, and support the design of the Pre-Demolition Survey.

1.1 Purpose

This *Reconnaissance Level Characterization Plan (RLCP)* presents RFETS' approach to conducting RLC, gives RLC implementation guidance to D&D project managers, and details how to consistently conduct RLC in a compliant, technically defensible, and cost-effective manner. Details include radiological and chemical characterization, volume estimation, radiological field instrumentation, laboratory analysis, data analysis and quality assessment, quality assurance and control, and RLC documentation. Effective and efficient implementation of RLC supports the goals of the *Rocky Flats Cleanup Agreement* (RFCA; DOE/RFFO, CDPHE, EPA, 1996) and RFETS' closure plans.

1.2 Characterization Scope

The scope of RLC is to define the radiological and chemical condition of buildings, including the nature and extent of contamination, physical hazards, obstacles, and other conditions that could affect decommissioning activities. Data are required for all building areas and features, including:

- Floors
- Walls (interior and exterior)
- Ceilings and roofs
- Doors, door and window frames
- Molding, stairs and railings, heating, ventilation and air conditioning (HVAC) systems
- Lighting and electrical systems
- Piping and conduit
- Fixed equipment.

RLC will identify existing data, assess their quality, identify data gaps, and obtain additional data to establish the basis for decommissioning activities.

Data will be obtained using approved and accepted characterization practices and methods. All characterization needs, including RLC needs, will be identified through implementation of the U.S. Environmental Protection Agency (EPA) data quality objective (DQO) process as defined in Section 3.0 of the RFETS D&D Characterization Protocol. The process to identify characterization needs and specifications includes defining the problem that requires data and the decisions to be made, identifying inputs to the decision and the decision boundaries, developing the decision rules, setting acceptable error tolerances, preparing the characterization design, and optimizing the design as additional information becomes available.

1.3 MARSSIM and Regulatory Compliance

The RLC is designed to conform to MARSSIM and to comply with applicable or relevant and appropriate requirements (ARARs). For example, criteria for decision-making (refer to Section 3.0) are based on regulations, and radiological surveying and sampling methods are based on MARSSIM, as they apply.

1.4 Data Life Cycle

Results of scoping characterization, which precedes RLC and includes historical site assessment and facility walkdown, are evaluated to identify data gaps that need to be filled during RLC. If data gaps are identified through the DQO process, additional sampling/surveys are conducted. If data gaps are not identified, additional sampling/surveys are not conducted, and an RLC report (RLCR) is prepared. The RLCR will identify the proposed facility classification, based on identified radiological and chemical hazards, to the U.S. Department of Energy (DOE), the Colorado Department of Public Health and the Environment (CDPHE), and the EPA (refer to Section 9.0). Results from RLC also will be used to design in-process characterization and the pre-demolition survey. Refer to Section 2.0 of the RFETS D&D Characterization Protocol and Section 2.0 Of the RLCP for additional information on the various characterization phases.

2.0 SITE INFORMATION

This section contains an overview of the historical use of RFETS and how the RFETS buildings will be categorized for decommissioning purposes. In addition an overview of the characterization process and the date initial contamination is also included.

2.1 Site Description

Built in the early 1950's, the Rocky Flats Plant near Denver, Colorado, is part of a nationwide nuclear-weapons complex owned and administered by the U.S. Department of Energy. The primary mission of Rocky Flats has been the manufacture of nuclear and non-nuclear components for nuclear weapons, and at the same time of its shutdown in 1989, it was the only U.S. facility conducting production-scale weapons fabrication with plutonium.

The main plant has 436 buildings, facilities, systems, and structures, of which 150 are permanent buildings and 90 are trailers used mainly for office space. Together, they provide approximately 3 million square feet of facility space.

The facilities at Rocky Flats are divided into two main areas. The area on the north contains all of the facilities related to plutonium operations. Security fences and intrusion-detection systems surround all buildings in which plutonium is handled or stored, and various other measures are used to provide safeguards and security. This area is referred to as the "protected area." The area to the south contains both non-plutonium manufacturing facilities, which are located in secured areas, and general support facilities, some of which are in secured areas.

2.2 Facility Type Descriptions

RLC activities vary based on the facility type. RFETS facilities have been tentatively typed based on historical information and process knowledge. This classification will be confirmed during RLC and documented in the RLCR. Site facilities are classified, per the *Decommissioning Program Plan* (DPP; K-H 1998), as one of three types.

Type 1 facilities are "free of contamination;

Type 2 facilities contain some radiological hazardous substance contamination; and

Type 3 facilities contain extensive radiological contamination, usually as a result of plutonium processing operations or accidents.

2.3 Building Cluster Descriptions and Cluster Conditions for Reconnaissance Level Characterization

RFETS D&D activities, including characterization, will be conducted by building clusters. In general, clusters include one or two major process buildings and associated ancillary buildings.

The number of buildings in a cluster varies depending on the size and complexity of buildings.

Building clusters may have undergone deactivation, pursuant to the DPP and the FDPM, prior to RLC. Process equipment may have been drained, and equipment (unfixed), furniture, stored items (e.g., chemicals, tools, and supplies), and other materials may have been removed. Fixed equipment, process piping, ventilation systems, and utilities will remain until after RLC and strip-out activities commence. Such equipment, piping and systems will limit the extent of RLC, and inaccessible areas will have to be characterized during and after strip-out activities.

2.4 Scoping Characterization

Prior to initiating RLC, D&D projects need to conduct scoping characterization. Scoping, as defined in the DPP and the *D&D Characterization Protocol*, establishes the preliminary scope of the project (i.e., schedule, budget, risk, and approach) and the facility type. Establishment of the scope includes identifying the physical boundaries of the areas to be characterized. Establishment of the anticipated facility type requires information regarding building hazards, including hazardous and radiological conditions. Therefore, information gathering is required and includes building walk-downs, interviewing building personnel, and reviewing historical and operational building information [historical site assessment (HSA)]. Objectives of this scoping characterization include:

- Identifying history of buildings and rooms;
- Identifying potential, likely, or known sources of radiological material/hazardous substances and/or contamination, including history and nature of material/substance storage, use, spills, and waste handling;
- Providing a preliminary assessment of contaminant migration, including migration pathways and human and environmental targets; and
- Providing information that may be useful in other characterization phases, and/or a recommendation on whether further action is warranted.

Sources of information include Safety Analysis Reports, operating records, incident reports, radiological surveys, radiological improvement reports (RIRs), Plant Action Tracking System (PATS), Historical Release Reports (HRRs), and Waste Stream Residue Identification and Characterization (WSRIC) building books.

Scoping provides a basis for preliminary evaluations of decommissioning efforts and aids in identifying the need for more extensive RLC and In-Process Characterization (IPC) surveys. Results are incorporated into the RLC Report (RLCR) as a basis for additional characterization, based on identified data gaps.

2.5 Contaminants of Concern

Contaminants of concern are the contaminants associated with a building, room, portion of a room or equipment that the item needs to be sampled/characterized. Contaminants of concern are divided into two broad categories radiological and chemical.

72

2.5.1 Radiological Contaminants of Concern

The main radiological contaminants of concern processed on-site are uranium and plutonium. Plutonium (Pu) used on-site was in the form of Weapons Grade Plutonium (WGP). Uranium (U) used on-site was in the form of Highly Enriched Uranyl Nitrate (HEUN) and Depleted Uranium (D-238).

According to an analysis performed by Sandia National Laboratories (Sandia 1978), WGP can be assumed to contain the following primary isotopes of concern and associated weight fractions: Pu-238 (0.03%), Pu-239 (93.9%), Pu-240 (5.7%), Pu-241 (0.3%), and Am-241 (0.02%). The specific activity (curies/gm) of WGP is driven by the mass of Pu-239 and Pu-240. Combined, they account for approximately 87 percent of the alpha activity. The remainder of alpha activity is due to the decay of Am-241, Pu-238, and Pu-241.

HEUN includes U-234, and U-235. The specific activity varies with the percent enrichment. HEUN enriched to 90 percent U-235 shows a ratio of 127.8 dpm alpha to 1.1 dpm beta.

Depleted Uranium (D-238) is natural uranium which has been processed to remove U-235 (approximately 0.2% U-235 by weight remains with the D-238). D-238 consists of U-238, U-238 daughter products and U-234. U-238 decays by alpha emission and has two daughter products in secular equilibrium: Th-234 and Pa-234^{m}. Th-234 and Pa-234^{m} both decay by beta and gamma emission.

Plutonium is primarily an alpha emitter, whereas uranium is both an alpha emitter and a beta-gamma emitter. There is historical knowledge that indicates other radionuclides (e.g., beta-gamma emitters such as Sr-90, tritium, assorted radioactive sources, and mixed fission products) have been used in some of the buildings on-site.

Buildings that have beta-emitters will be identified during the HSA/Scoping Phase. If the HSA/Scoping Phase identifies that only portions of these buildings have the potential for beta-gamma emitters, then only those portions will be surveyed for beta-gamma emitters. If the HSA/Scoping Phase could not determine if beta-gamma emitters were used in the facility, then beta-gamma RLC surveys NIU be performed. If the HSA/Scoping Phase determines that beta-gamma emitters are not a potential source of contamination in a building, then only alpha surveys will be performed. Buildings containing beta-gamma emitters will be surveyed in the same manner as outlined in the Section 4.0. Surveys/samples may be taken to identify the isotope mix. In addition to performing beta-gamma surveys in these selected buildings, alpha surveys will also be required of all building surfaces.

Prior to beginning RLC surveys, it is important to identify if the facility is either uranium contaminated, plutonium contaminated, or both, so that the appropriate RLC DQO Derived Concentration Guideline Level –Wilcoxon Rank Sum Test ($DCGL_{WS}$) (refer to 8.2.1) is used. This determination should be made during the HSA/Scoping Phase. If the facility contaminate of concern (uranium or plutonium) cannot be determined during the HSA/Scoping Phase, then the facility RLC surveys should include a FIDLER survey to identify the presence of beta-gamma emitters.

2.5.2 Nonradiological Contaminants of Concern

The presence of nonradiological contaminants of concern needs to be evaluated during RLC. Chemicals include volatile and semi-volatile organic compounds (VOCs and SVOCs), heavy metals, beryllium (Be), PCBs, and asbestos. These are hazardous and regulated substances, especially in waste material. VOCs, SVOCs, heavy metals, and PCBs could be present in low concentrations from historical spills. It is assumed that spills would have been cleaned up and that only residual amounts would be present in the building matrix. Contaminated materials would primarily be regulated by waste management regulations [e.g., RCRA, Toxic Substance Control Act (TSCA) and CHWA] as contaminated debris (waste). All containerized chemicals will be removed from the building during building deactivation prior to RLC. Heavy metals and PCBs could also be present in building material, such as paints and electrical cabling. Be could be present in areas where Be operations and storage occurred, including in ventilation systems. Asbestos could be present in various building materials (e.g., piping and tank insulation, floor tiles, transite wall coverings, and roofing material) and in various forms (friable and non-friable).

3.0 RADIOLOGICAL CHARACTERIZATION

3.1 General Survey Protocols

If radiological data gaps are identified during the DQO process, additional RLC surveys and/or sampling shall be conducted per this RLCP. RLC surveys should provide an overall assessment of the radiological hazards associated with each facility. Each facility will be classified based upon the level of potential or existing radiological material. The scope of the RLC survey will be based on the facility type, HSA/Scoping Phase results, and process knowledge. RLC surveys will be performed on a graded approach for Type 2 and 3 facilities.

3.1.1 Survey Design

RLC survey measurements will be conducted in accordance with approved procedures and specific survey instructions provided in survey packages. Removable and total activity measurements for both alpha and beta/gamma contamination, and surface scans will be performed in accordance with Radiological Safety Practices procedure 3-PRD-165-RSP-07.02 Contamination Monitoring Requirements. Media and volumetric sampling will be performed in accordance with CAS SOP-003, Sampling for Waste Characterization. A sufficient number of measurements will be taken to conclusively demonstrate that the RLC DQOs have been achieved (see Appendix A). The measurements will be obtained by conducting surveys using approved methods and techniques such as surface scans, direct and removable surface activity measurements, and media or volumetric samples.

All areas within facilities may not have the same potential for contamination therefore, will not require the same level of survey coverage to meet the DQO process. The results of the HSA/Scoping Phase will be used to aid in the design of the RLC survey.

Based on the FDPM, facilities have been initially screened and grouped into Type 1, Type 2, or Type 3 facilities. Facilities will be further broken down into survey areas during the design of the RLC survey. A survey area is a general term referring to any portion of a facility. For example, a survey area could be a group of facilities, a single facility, or one or more rooms within a facility. Survey areas will be determined by current radiological postings and the size of the areas being surveyed. Radiological Building Engineers (RBEs) will be responsible for dividing their respective facility into appropriate survey areas. Type 2 and 3 facilities will be divided into surveys areas as described in Appendix A, Radiological Summary Table.

3.1.2 Walkdown

Walkdowns of the facilities will be a key activity in the preparation of the survey design. The principal objective is to assess the physical scope of the survey areas. Specific requirements will be identified for accessing the survey areas and support functions necessary to conduct the surveys, such as scaffolding, temporary utilities, interference removal, engineering modifications, and electrical lockout/tagout to provide access for surveys. Safety concerns, such as access to confined spaces, high walls and ceilings, will be identified.

In addition to survey design preparations, walkdowns shall be performed to provide an overall assessment of the radiological hazards of each facility. Walkdowns should identify radioactive waste storage areas, potential and actual contaminated areas, permanently installed sources, and other radiological hazards that could affect decommissioning activities. Walkdown information will be used to assist in the development of survey instructions, and will be documented in the RLCR.

3.1.3 Field Support

Field support may be required to access and survey infrequently occupied areas, such as overhead areas, high walls and confined spaces. Temporary utilities, such as electrical power, lighting, and heat, may be required to support surveys. Scaffolding and man-lifts may be required to access overhead areas. Coordinate with project management personnel to obtain necessary support.

3.1.4 Survey Instructions

Survey instructions will be documented in individual survey packages for each survey area. Survey packages are prepared prior to the performance of RLC surveys, and will contain the instructions, survey maps, and other necessary information to direct the performance of surveys. The survey instructions will specify the minimum number, type and location of required survey measurements, and the amount of surface area contained within each survey area. Survey instructions will be specified on established forms and placed in the survey package.

The preparation of a survey package is a dynamic and interactive process. As a result, flexibility is required to permit survey personnel and supervision to resolve the various situations that may arise. To ensure data collection is optimized, all survey areas should be walked down as a part of the survey package development. Copies of all survey data collected during the performance of the RLC survey shall be included in the respective survey package.

3.1.4.1 Measurement Locations

Measurement locations are selected to allow for a concentrated survey effort in those areas most likely to be contaminated, based on the HSA/Scoping Phase and facility type.

Surveys will consist of removable and total activity alpha and beta-gamma measurements, and surface scans. Surface media sampling and volumetric sampling will be performed on an as needed basis based on RBE judgement. Measurement locations shall ensure uniform coverage of the area, as well as biasing measurements at locations most likely to accumulate contamination. Additionally, a representative number of total and removable measurements will be taken on fixed equipment in each survey area. The number of measurement locations will be based on the current radiological postings of the area, and the size of the area being surveyed. Refer to Appendix A, Radiological Summary Table for minimum survey measurement requirements.

3.1.4.2 Designating Measurement Locations

Measurement locations may be identified to provide a method of referencing survey results to survey area locations. RLC measurement locations should be identified on the facility surfaces using self-adhesive labels, or equivalent. The labels, or equivalent, should be annotated with the corresponding survey map reference location number. Since PDS measurement locations will also be identified on the facility surfaces using self-adhesive labels, or equivalent, the RLC labels should be unique relative to the PDS labels (e.g., different colored labels).

RLC survey measurement locations should be uniformly distributed throughout the survey area. Additional judgment survey measurement locations, above the minimum required measurements, may be selected based on RBE judgement. Judgment survey measurement locations should be determined based on unusual appearance, relative locations to high contamination areas, high potential for residual activity, or general supplemental information that may warrant additional characterization measurements.

3.1.4.3 Survey Maps

Survey maps will be used to define the boundaries of survey areas and to document measurement locations. Survey maps will be prepared for specific survey areas to identify structures, systems or equipment. RLC survey maps do not need to be scaled, nor do grid overlays need to be used.

A unique reference location number will identify survey measurement locations on survey maps. The numbering convention will allow the survey data to be easily referenced to survey points identified on the survey maps.

3.1.4.4 Surface Scans

Scanning surveys will be performed to screen areas to search for areas above the average release limits and to detect localized areas above the maximum release limit. The scanning methods utilized (instrument and survey technique) will be designed to detect at, or below, the derived concentration gridline level elevated measurement concentration ($DCGL_{EMC}$) values. If an area of elevated activity is identified during the scan of a survey area, the location will be marked and surface activity measurements for removable and total activity will be collected at that location in addition to the prescribed set of uniformly distributed measurements for the survey area.

For survey areas containing the floors and walls below two meters a minimum of one square meter will be scanned around each surface activity measurement location. Additionally, biased scans will be performed at locations with the highest potential for contamination (e.g., horizontal surfaces, high traffic areas, floor corners, and floor drains) based on RBE judgment. The locations of biased scans should be annotated on the survey maps.

Scans will only be performed if contamination is identified during total or removable surveys for survey areas containing ceilings and walls above two meters, exterior walls and roofs, and equipment. Biased scans may be performed based on RBE judgment. The locations of biased scans shall be annotated on the survey maps.

3.1.4.5 Surface Activity Measurements

Surface activity measurements will be taken at measurement locations based upon current radiological postings of the area and the size of the area being surveyed. Specific guidance regarding the location and number of measurements will be provided in survey package instructions. The set of surface activity measurements will consist of total and removable measurements, at each measurement location. Instruments utilized for the detection of total and removable surface activity will have a minimum detectable concentration (MDC) no greater than the RLC $DCGL_W$. Both positive and negative measurement results shall be recorded. If RLC surveys are being used for planning pre-demolition surveys, then actual RLC values (positive and negative) shall be recorded.

A minimum of 30 surface activity measurements will be taken at uniformly distributed locations for survey areas containing the floors and walls below 2 meters, and exterior walls and roofs. Additional, biased surface activity measurements will be performed in these survey areas at locations with the highest potential for contamination (e.g., horizontal surfaces, high traffic areas, floor corners, and floor drains) based on RBE judgment.

For equipment survey areas, a minimum of 30 surface activity measurements will be taken at biased, accessible locations. Equipment measurement locations should be taken both below two meters high and above two meters, and distributed uniformly according to amount of fixed equipment above and below two meters high. If a survey area does not contain fixed equipment, or there is not enough equipment to justify taking 30 measurements, the amount of equipment measurements may be decreased based on professional RBE judgement.

For survey areas containing ceilings and walls above two meters, a minimum of 10 surface activity measurements will be taken at biased, accessible locations. Surface activity measurements will not be performed on interior surfaces of plant systems. The evaluation of these surfaces will be based upon HSA/Scoping Phase results.

78

Automated surface contamination monitors (SCMs) may be utilized for the detection of total surface activity, provided the instrument MDCs are no greater than the RLC $DCGL_W$. SCM sample density may exceed the sample requirements that would be required by MARSSIM. SCMs obtain approximately four hundred 25-cm^2 measurements for each m^2 surveyed. The maximum, minimum, mean, and standard deviation is also calculated for each m^2. Therefore, the use of these monitors fulfills the requirement for scan surveys as well. In conjunction with the SCMs, small hand-held detectors will be utilized to perform scan surveys in hard to reach areas. The use of the SCMs will enable the acquisition of quantities of data far in excess of MARSSIM statistical guidance. The reports generated by the SCMs include the following statistical parameters: maximum, minimum, mean and standard deviation for each square meter surveyed. Reference material background beta-gamma measurements will not be used for RLC surveys performed using the SCMs because the background is determined through an approved statistical analysis of the survey data. Appendix A survey requirements will be achieved when SCMs are utilized for RLC surveys.

3.1.4.6 Surface Media Sampling

Surface media samples (e.g., paint, flooring material, roofing material, sediment, etc.) may be collected for analysis as part of biased sampling measurements. Such samples may be collected in drain receptacles, sumps, and other catchments. These samples will be analyzed for alpha and beta-gamma emitting radionuclides. No minimum number of samples will be required, however, the goal of media sampling during the RLC phase is to determine if contamination exists in media or underneath media, and the spatial distribution of the contamination. The quantity and distribution of the media samples should be such that, if contamination above the RLC $DCGL_W$ is not identified, then no further media sampling would be required during the PDS phase. If media contamination is identified during the RLC phase, then additional media sampling may be warranted during the IPC phase. RBE judgement will be used to determine the number of biased samples and the sample locations for each survey area.

Before obtaining media samples the sample location should be surveyed for total and removable surface activity. If the surface contains removable contamination, then the surface should be decontaminated prior to media sampling. After media samples are collected the sample location should be re-surveyed for total and removable surface activity. The results of the post-media sampling survey will assist in determining if contamination exists under the media. To perform a representative post-media sampling total surface activity survey, the size of the media sample should be at least as large as the detector probe face.

To reduce sampling analysis costs, samples from areas that have similar contamination potentials may be composited. For example: if three samples are taken on a wall that has the same contamination potential, then the three samples may be composited. Media samples from a high contamination potential floor should not be composited with a low contamination potential wall. Care should be used when evaluating which samples to composite to ensure the RLC DQOs are satisfied.

3.1.4.7 Volumetric Sampling

It is generally assumed that if there is no contamination on building surfaces, then there is no reason to suspect volumetric contamination below the surface. It is also generally assumed that if contamination is found on building surfaces, contamination levels will be highest on the surface and decrease as surface material is removed. Therefore, it is not anticipated that volumetric samples will be routinely required during the RLC phase, however, there may be circumstances that are identified during the HSA/Scoping Phase that may warrant volumetric sampling.

Volumetric samples (e.g., concrete or cinderblock core bore samples) may be collected for analysis as part of biased sampling measurements. Such samples should be collected at areas where contamination may have migrated into base materials. For example, volumetric samples should be required in rooms that have a history of repeated, contaminated liquid spills and the surfaces are cracked. These samples will be analyzed for alpha and beta-gamma emitting radionuclides. If volumetric samples are obtained, no minimum number of samples will be required. RBE judgement will be used to determine the number of biased samples and the sample locations for each survey area.

To reduce sampling analysis costs, samples from areas that have similar contamination potentials may be composited. Specific volumetric media sampling instructions will be provided in survey package instructions, as necessary.

4.0 CHEMICAL CHARACTERIZATION

The characterization practices outlined in Sections 5.1 through 5.5 are specifically designed to provide waste characterization information and occupational hazard assessment in support of activities to facilitate RFETS building disposition. If data gaps involving the nonradiological contaminants addressed below are identified during the DQO process, additional RLC surveys will be conducted per this RLCP.

All sampling will be in accordance with the Job Hazard Analysis (JHA) and the Activity Hazards Analysis (AHA). These documents, reviewed and approved by Industrial Hygiene (IH), outline potential hazards involved for sampling activities, describe proper Personal Protective Equipment (PPE), and outline safety precautions to be utilized during the specified sampling activity. Additionally, a structural engineer should be consulted if there are any concerns about the structural integrity or stability of any building being characterized prior to entry or sampling. In all cases, sampling locations will be directly affected by radiological concerns. As necessary, the RBE will prepare an as low as reasonably achievable (ALARA) job review to direct this activity.

4.1 Lead and Other RCRA Metals

All materials, equipment, or media suspected of containing lead and/or other RCRA metals as a bulk or principal ingredient (e.g., construction materials such as shielding, surfaces potentially containing residue from metal chemical processes, treatment, or spills, etc.) will be managed as hazardous wastes under RCRA, unless either process knowledge or analytical data establish that the materials are not subject to hazardous waste disposal regulations. Paint chip samples may be taken as necessary to support waste characterization or IH concerns .

Historical data such as maintenance records, blueprints, as-built drawings, specifications and emergency response documents will be consulted to determine if processes involving RCRA metal compounds have been carried out in the area under characterization. If so, specific packages will be developed for sampling to determine whether contamination occurred. In some cases, RFETS may propose individual exit criteria for specific materials.

In general, porous materials in contact with RCRA listed or characteristic waste or with hazardous material that could lead to a characteristic or listed waste signature will be subjected to Toxicity Characteristic Leaching Procedure (TCLP) analysis.

For example, processes involving metal-based oxidants for control of algal and fungal growth (e.g., hexavalent chromium compounds) may have been carried out in water holding tanks or treatment facilities. If no information is available about levels of potential residues, then a minimum of three samples of media potentially in contact with the metal contaminant plus a duplicate will be taken for TCLP analysis. Metals bound for recycling will generally not be sampled since they are not subject to RCRA limits.

4.1.1 Identification and Location of Samples

A physical tour of each building will be conducted, entering every accessible area and room, looking for suspect (or affected) materials that may indicate through historical data or based on the inspector's experience, the presence of lead or other RCRA metals. A suspect list will be generated, along with estimated quantities. Generic types of materials potentially containing lead and/or other RCRA metals include but are not limited to the following:

- paints and coatings, characterized by color, texture, and luster
- gloveboxes and associated shielding equipment
- piping
- plates, bars, brackets, and shields
- lead fills in walls
- skirting
- additives (e.g., in plaster)
- areas in which chemical processes or treatments involving metals or metal compounds are known or suspected to have taken place (e.g., hexavalent chromium treatment).

Bulk lead is expected to be a common form of lead generated during D&D efforts. In general, TCLP analysis of lead in this form yields a result greater than the 5.0 mg/L regulatory level listed under 40 CFR 261.24, and the lead must be treated as RCRA waste under hazardous waste number D008. Sampling and TCLP analysis of this form of waste stream is considered excessive for purposes of designating the waste as hazardous, based on reliable process knowledge that indicates the waste is hazardous. As a result no sampling of the bulk lead is necessary for determination of the related waste as hazardous.

For media other than paint or coatings where lead or metals contamination is suspected based on color, age, or other characteristics, core or grab samples will be taken for TCLP analysis by a method described in Section 5.1.2. A minimum of three samples a duplicate will be taken. If this approach seems conservative, judgment samples or random samples should be collected based on the direction from the field manager and the Subject Matter Expert (SME) involved with the project. The locations of the random samples will be determined by generation of a grid as described below in Section 5.3.1.

Alternatively, a representative sample that is a physical average of the entire batch will be subjected to TCLP analysis, and the resultant value compared to the regulatory level given by 40 CFR 261.24.

In some circumstances, a total metals analysis may be performed on media to provide preliminary characterization information.

Although the building slab is not within the scope of RLC, any floor surfaces above the ground floor or other elevated surfaces that are not part of the slab will be sampled. Additionally, locations of spills or potential contaminations of the slab noted during walkdown will still be noted for use during later phases of characterization.

Dust sampling may be required in areas where surfaces coated with lead-based paint, coating are severely cracked or deteriorated, or significant hazard of worker exposure to lead-containing dust exists, as determined by the IH. A minimum of three samples and a duplicate will be taken. If this approach seems conservative, judgment samples or random samples should be collected based on direction from the field manager and SME involved in the project. The locations of the random samples will be determined by generation of a grid as described below in Section 5.3.1.

That lead exposure potentials may become acute when some degree of stripout begins. For example, instances in which metal pipes or shielding must be cut or torched, or where paint is removed or paint-covered surfaces scabbled will require sampling in addition to that carried out under RLC to provide appropriate data for purposes of worker safety and waste characterization.

Special considerations for lead paints and coatings

RFETS has determined, using process knowledge and site-specific analytical measurements, that lead-containing paints on building infrastructure are not RCRA characteristic hazardous wastes for purposes of disposal, as long as that paint is a part of infrastructure and NOT removed from its substrate (i.e., scabbled or scraped) to generate a separate waste stream. In some high contamination areas (HCAs), coats of paint were used to cover and shield radiological contamination, and this infrastructure paint may be considered characteristic hazardous waste, and must be managed as such unless verifying analytical data are obtained. Sampling these areas will be required. For HCA sampling, each paint type (as categorized by color, texture, and lustre) will have two samples taken, with the second considered a duplicate for evaluation of overall project precision.

Sampling of lead levels in paints and settled dust may be required for assessment of IH issues such as work practices, engineering controls, and decisions on PPE. This is particularly important in areas where lead-coated surfaces are to be scraped, scabbled, torched, or otherwise disturbed in such a way as to cause lead particles or dust to potentially become airborne.

In addition to lead-based paint, zinc-based rust inhibitors applied to steel I-beams also contain lead, and may serve as a source of potential airborne lead during decommissioning, removal, or demolition of structures.

In all cases, IH will ensure that all requirements in the Occupation Safety and health Administration (OSHA) Lead Standard (29 CFR 1926.62) for lead measurements and worker safety are met in these instances.

Sampling for the determination of lead or other metals in paint or other media is itself a destructive method that may release dust. Although material and paint chip samples are to be collected from inconspicuous areas, proper safety precautions will be taken to prevent the spread of suspect materials. The following is a summary of the potential reasons to sample for lead:

- As needed to comply with RFETS Health and Safety requirements and the OSHA lead standard,
- On vertical cores where thick coats of possible lead-based paint have been used in HCA areas for its shielding properties;
- To characterize scabbled paint residues.

4.1.2 Media Sampling

All samples will be collected by the method appropriate to the type and location of the suspected metal contamination, as described in the Metals and PCB Characterization Procedure. When TCLP is used, the SW-1311 preparation method **SHALL** be employed. EPA SW-846 specifies details and methods for the determination of lead and other metals, including cadmium, chromium, zinc and arsenic, in solids. These sampling procedures include:

Coring. Coring will be the preferred method for bulk sampling. The coring technique is described in Metals and PCB Characterization Procedures, and is based upon American Society for Testing and Materials (ASTM) Method E1729-95, *Standard Practice for Field Collection of Dry Paint Samples for Lead Determination by Atomic Spectrometry.* Coring will not penetrate any surface to a depth of greater than two inches unless possibility of contacting an energized circuit can be ruled out. No less than 100 but no more than 200 grams of bulk sample is required. The lead and metals content will be analyzed by method SW6010A.

Paint chip analysis. The technique for removal of paint chips utilizing a chisel, putty knife, blade, etc., is described in Metals and PCB Characterization Procedures, and is based upon ASTM Method E1729-95, *Standard Practice for Field Collection of Dry Paint Samples for Lead Determination by Atomic Spectrometry.* Sampling for metals in paint requires that the paint chip sample be a minimum of four square inches in size. Minimum weight is two grams. Sample size will be adjusted accordingly. The goal is to remove all layers of paint equally, but to avoid removing any substrate. The lead and metals content will be analyzed by method SW6010A.

Dust sampling. Lead content in settled dust will affect Industrial Hygiene considerations for work in a given area. Dust on horizontal surfaces will be sampled using a micro-vac technique that requires the use of a template that sequesters a 10 square inch pattern. The sampling tool is a low volume battery powered air sampling pump calibrated at two liters per minute with a 25 mm mixed cellulose ester (MCE) filter media cassette attached. A two-inch section of Tygon tubing is attached to the upstream side of the cassette and facilitates pickup of all loose dust in the grid area. Each sample is documented as to location, the cassette is labeled with an identifying number, and sealed. The sample number is documented on the chain of custody form. The sample location may be photographed with a sample photo identification card in the focus area documenting the sample number and date, and orienting the viewer to the sample location with an arrow.

All samples will be assumed to be radiologically contaminated until it is determined by appropriate radiological survey that they are not. Each sample must be described in the sampling log with respect to both location and sample source (i.e., floor, table, glovebox, etc.) in such a way that it is uniquely identified for follow-up sampling if needed.

Samples will be processed by an EPA/American Industrial Hygiene Association (AIHA) laboratory. Appropriate sample submittal forms shall be used. The field sample number shall appear on the field sampling form, the laboratory submittal form, and the container label. The name of the laboratory, the date the samples were sent to the lab, and all personnel handling the sample from the time of collection to the time of arrival at the laboratory shall be recorded on a chain of custody form.

4.2 VOCs and SVOCs

VOC and SVOC contamination, if present, is expected to be confined to localized areas surrounding locations where such chemicals were used, stored, or spilled, particularly in enclosed spaces, or absorbed into porous media. Even though the contaminants are by definition volatile, they may remain present in porous media for a significant length of time particularly if the surface has been painted or if other activities have taken place which might impede volatilization and dispersal.

Historical records will be consulted to discover whether use or storage of VOCs/SVOCs occurred in the building, which specific VOCs/SVOCs were used, where within the building these activities took place, and whether spills have been recorded or suspected. A physical tour of the building will be carried out, entering every physically accessible area and room, and noting areas suspected of VOC/SVOC contamination. A list will be generated, along with an estimate of the size of the area likely to be involved.

Several VOCs are classified as listed or characteristic wastes under RCRA. If these contaminants are suspected, intrusive samples will be conducted as described for TCLP analysis.

4.2.1 Identification and Location of Samples

During the physical tour of the building, particular attention will be paid to storage cabinets, enclosed spaces, tanks, equipment or pipes likely to contain solvents and areas of staining on the floor , particularly on porous surfaces into which VOCs/SVOCs may have penetrated. If leaking containers are present, the identity of their contents will be noted, and an estimate of the volume of the spill will be made if possible.

Suspect areas and materials should be screened with a photoionization detector and flame ionization detector (PID/FID) for detectable organic vapor concentrations, operated in accordance with procedure F0.15, *Photoionization Detectors and Flame Ionization Detectors*. In cases that require opening an enclosed space, vat, pipe, or piece of equipment, IH will ensure that proper safety precautions are met to avoid worker exposure, asphyxiation danger, or fire/explosion hazard.

If PID/FID analysis or the actual presence of a visible spill indicates the likelihood of a VOC/SVOC contamination, an investigation of historical records and process knowledge will be undertaken to determine the likelihood that the contaminant is regulated under RCRA. If the identity of the contaminant cannot be definitely established as a non-RCRA material, or if RCRA-regulated materials are found to have been used or stored in the area, sampling will be undertaken as in Section 5.2.2. For spills on porous materials, core or grab samples will be taken for TCLP analysis by a method described in Section 5.2.2. A minimum of three samples and a duplicate will be taken, where this approach may be conservative, judgment samples or random samples will be collected based on the direction from the field manager and the SME involved in the project. The locations of the random samples will be determined by generation of a grid as described below in Section 5.3.1.

Alternatively, a representative sample will be subjected to TCLP analysis and the resultant value compared to the regulatory level given by 40 CFR 261.24.

The results from these analyses will be compared to the action levels set by the RFCA (Attachment 5, "RFETS Action Levels and Standards Framework for Surface Water, Ground Water, and Soils"). If media exceed RCRA TCLP contamination thresholds as listed in 40 CFR 261.24, they will be managed according to RCRA requirements.

4.2.2 Media Sampling

Measurements by PID/FID that indicate VOC/SVOC vapor concentrations above background in areas where RCRA-regulated VOCs/SVOCs are known or suspected to have been used or stored will be followed by intrusive samples which will be analyzed according to the EPA SW-846 Method 8260B for total VOCs or Method 8270C for total SVOCs.

For spills on porous materials, a minimum of three intrusive samples and a duplicate will be taken by a method appropriate to the medium upon which the spill has occurred. Due to potential risks of flammability and explosion, IH will determine proper safety precautions. For spills upon non-porous materials, an appropriate decontamination procedure will be carried out under the supervision of IH.

Each sample must be described in the sampling log with respect to both location and sample source in such a way that it is uniquely identified for follow-up sampling if needed.

4.3 Beryllium

RFETS has determined, using process knowledge, that Bedust, particles, scrap, and other products of Be metal processing carried out at RFETS does not meet the criteria for a RCRA hazardous waste. In some cases, Be powder in the form of a product of a chemical process (P015 listed under RCRA) was used on-site. If it can be proven and documented through historical records and process knowledge that a material is in fact contaminated with this P-listed form, the material will be treated as RCRA waste and subject to treatment standards under 40 CFR 268.40, or else RFETS will propose release criteria for the material based upon surveys and available information. If Be in any form is identified such that it fits the criteria for an underlying constituent, it will be subject to Universal Treatment Standards as in 40 CFR 268.48.

The Chronic Beryllium Disease Prevention Program (CBDPP) has established human health standards such that if levels of beryllium are determined in a surface survey to be equal to or greater than 0.2 $\mu g/100\ cm^2$, the material is considered Be-contaminated per the Occupational Safety and Industrial Hygiene Program Manual, Chapter 28. RFETS IH considers material with less than 0.2 $\mu g/100\ cm^2$ beryllium as suitable for free release for public use within RFETS.

Historical records will be consulted to determine whether Be activities or storage are known to have occurred at the building being characterized and if so, in which rooms or areas this took place. This determination should include consulting the Location of Known Beryllium Areas (LKBA).

However, it is important to note that historical data are insufficient for precise categorization of a building with regard to beryllium contamination. The LKBA did not specifically address locations of beryllium storage. For example, when beryllium materials were consolidated for removal from Bldg. 779, beryllium materials were found in 16 rooms not previously identified.

Data collected in other surveys, such as baseline inventory and sampling conducted by Chronic Beryllium Disease Prevention Program (CBDPP), will be utilized as part of the RLC if they are available. This will avoid unnecessary and costly duplication of efforts. The CBDPP surveys include results of:

- Random, statistically-based surface contamination surveys of readily accessible surfaces;
- Selective (i.e., judgment) surface contamination surveys of readily accessible surfaces in rooms where beryllium activities are known to have occurred, and
- Breathing zone air samples in areas known or suspected to have Be surface contamination levels in excess of 0.2 $\mu g/100\ cm^2$.

The CBDPP surveys do NOT address less accessible areas important for D&D considerations such as ductwork, hoods, and areas not readily accessible to traffic and cleaning. Since workers may be exposed to airborne Be during stripout of these areas, further Be swipe samples will be taken as necessary. Should the amount of Be contamination be expected to exceed 0.2 $\mu g/100\ cm^2$, IH must determine the use of PPE and breathing zone air monitoring.

4.3.1 Identification and Location of Samples

Using a risk-based approach, buildings or rooms within buildings with a higher probability of contamination will have a higher number of samples taken within them, whereas buildings or rooms with less risk will have correspondingly fewer samples taken. The decision tree for Be sampling is shown in Figure 1, Beryllium Sampling Decision Tree. The sample requirements to be taken in each building will vary depending upon the following criteria.:

- A building of known beryllium use, storage, or other source of potential contamination;

- A building which has exhibited detectable beryllium contamination on a previous survey, such as that done by CBDPP;
- A building in which beryllium use or storage is suspected, but for which historical data are not definitive.

A building of no known Be use but with *no* previous reliable survey data will be subjected to limited judgment sampling unless sufficient process knowledge and history can be obtained to justify no need for sampling. These data should be documented.

A building with known Be use or storage and *with* previous survey data under CBDPP or other reliable survey will be sampled further by judgment sampling if it is determined that previous survey data are insufficient to properly characterize the hazard to workers or to characterize the waste stream. For example, if all previous survey data for a known Be use area are negative, further samples will still be taken in poorly accessible areas such as ductwork, hoods, or spaces between equipment since if contamination occurs in these areas worker exposure may occur during stripout.

A building of known Be use but with no previous reliable survey data will be subjected to both random surface contamination sampling of readily accessible surfaces, and judgment sampling surveys of less accessible locations where Be activities are known or suspected to have occurred or where worker exposure during stripout is likely (e.g., ventilation ducts, light fixtures, etc). The number of samples and their locations will be determined by the grid method outlined below.

Further data needs will be evaluated as described in the decision tree (figure 1). For example, when samples are shown to exceed 0.2 $\mu g/100\ cm^2$, a decision must be made as to whether further sampling is required to adequately delineate the boundaries of the contamination. An important input into this decision is whether the contaminated material is planned to be decontaminated and free-released, recycled, released for restricted use, or disposed of as waste.

Both randomly selected and judgment measurements may be taken from the rooms within a building, depending upon history, process knowledge, and previously acquired data. Beryllium data sets from random sampling will be reviewed for distributional characteristics to determine which (statistical) tests are applicable for decision-making, i.e., whether or not an area is Be-contaminated. Data review methods are included in EPA G-9 other statistical texts may be referenced as needed, and will be cited if used. If data sets prove to be unsuitable for parametric statistics, non-parametric methods may be applied to determine if the level of beryllium is significantly above the action level.

The judgment sampling results will not be analyzed in this fashion. Rather, any individual result exceeding the action level will cause that material to be considered Be-contaminated, and segregated from other non-Be-containing waste streams. Further sampling may be required at the discretion of the field manager to delineate the boundaries of the contamination.

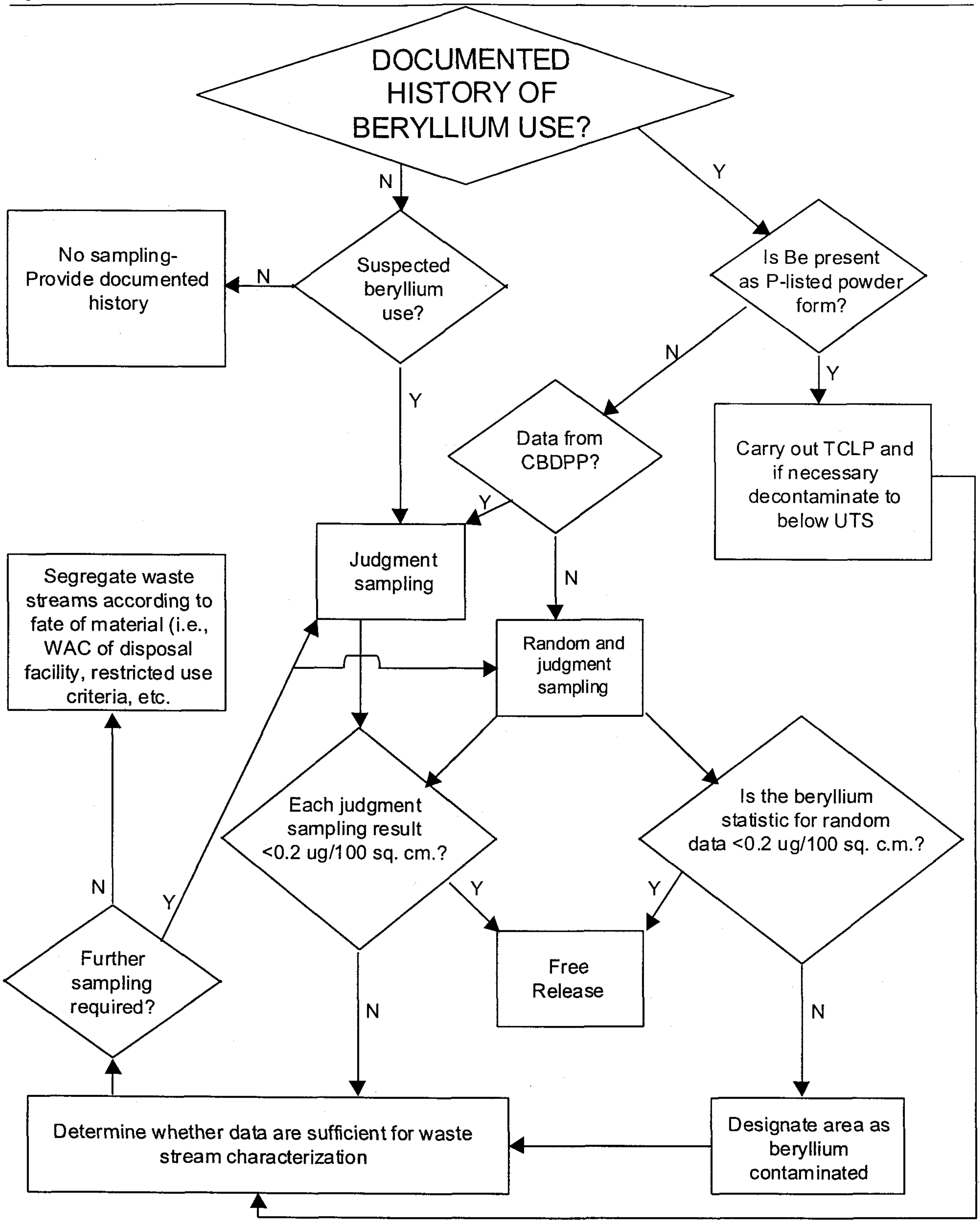


Figure 1. Beryllium Sampling Decision Tree

4.3.1.1 Sampling in areas of known beryllium activity

For known Be areas, it is likely that a characterization by CBDPP will have been carried out prior to RLC, making the following characterization unnecessary unless it is determined during RLC that further data are required to characterize the hazard to workers during decommissioning, removal, or demolition of structures. However, in the event that a known Be area requires RLC in the absence of prior survey data, the CBDPP methodology described below will be applied.

The number of total samples (random plus judgment) will be determined by room size. One random sample will be collected for every 100 square feet up to 1,000 square feet (or ten samples). No matter how small the room is, a minimum of five random samples will be collected. An additional random sample will be collected for every additional 200 square feet over 1,000 square feet up to 5,000 square feet total, and then one additional random sample for every 500 square feet with a maximum of 75 samples per area. For example, in a room with 200 square feet, 5 random samples would be collected.

Based upon the nature of beryllium work in many of the RFETS facilities, it is prudent practice to identify locations that have the highest potential for beryllium contamination and ensure that samples are taken from those areas. Judgment surveys will be carried out in such areas. Areas with the highest potential for Be contamination, and would serve as suitable locations for judgment samples, include but are not limited to:

- Around or on equipment known to have processed Be;
- Areas where Be waste was placed in containers, repacked, or bagged out;
- Ventilation dead zones where settling of airborne materials could have occurred;
- Areas along room exhaust paths including in front of room air exhaust filters;
- Areas that are hidden or difficult to access and not normally cleaned, particularly areas between walls and equipment, and;
- Traffic areas traversed by Be workers.

The minimum number of judgment samples collected in each building for which random samples are taken will be based on how the areas are delineated at the discretion of the field manager and the IH.

4.3.1.2 Sampling in areas of no documented beryllium activity

For locations where there were no documented Be activities, but for which sufficient process knowledge and history is not available to make a definitive decision, a limited number of judgment samples should be taken as described in Section 5.3.1.1. The same should be done when existing survey data are insufficient for proper characterization of the waste stream and potential hazards to workers during stripout. If no obvious locations such as gloveboxes, hoods, or ventilation ducts are available, the samples should be taken at locations unlikely to have been disturbed or cleaned such as on light fixtures, rafters, or ledges. A minimum of three samples and a duplicate will be collected per building.

4.3.1.3 Grid coordinate plan for random, statistically-based samples

Given the sample size determined for a room, a set of randomly generated coordinates will be used to locate each sample in the room. The Southwest corner, if accessible and determinable from the room configuration, will be designated as the coordinate system origin, location (0,0). If the Southwest corner cannot be used due to inaccessibility or non-conventional room configuration, the Northeast corner will be designated as the origin (0,0) instead. Uniformly distributed random coordinate pairs based upon the maximum East-West dimension and the maximum North-South dimension of the room will be generated to identify sample locations. For example, the pair (27,56) would identify a location 27 feet East and 56 feet North from the Southwest corner of the room. If the Northeast corner is designated as the origin, then the uniformly distributed random coordinate pairs would be recorded as negative numbers and indicate grid locations West and South, respectively, from the origin.

Sets of random number pairs for calculating sample locations in the field will be prepared before characterization sampling activities commence. These will be obtained from an RFETS site statistician.

The random samples are to be taken at the indicated location on the horizontal surface(s). In instances where a sample location falls in an area containing equipment, the outer surfaces of all equipment and the floor should be sampled (if the floor is accessible). Equipment is defined as tables, pipes, light fixtures, glovebox tops, file cabinets, drums, crates, and other process equipment. Ceilings and walls are not included. Each sample taken at a location must be described in the sampling log with respect to both location and sample source (i.e., floor, table, glovebox, etc.) in such a way that it is uniquely identified for follow-up sampling if needed.

Although the building slab is not within the scope of RLC, any floor surfaces above the ground floor or other elevated surfaces that are not part of the slab should be sampled.

Additionally, locations of spills or potential contaminations of the slab noted during walkdown should still be noted for use during later phases of characterization.

4.3.2 Media Sampling

Sampling technique will depend upon the nature of the surface to be surveyed. Non-porous surfaces will be sampled by swipe surveys. An area of 100 cm^2 will be swiped using Whatman 41 filter papers or equivalent. The filter paper will then be placed in a glassine bag. The surface sample number will be written on the bag. Porous surfaces will be sampled using a micro-vac technique that requires the use of a template that sequesters a 100 cm^2 pattern. The sampling tool is a battery- powered air sampling pump with a 25 mm MCE filter media cassette attached.

A two-inch section of Tygon tubing is attached to the upstream side of the cassette and facilitates pickup of all loose dust in the grid area. Each sample is documented as to location, and the cassette is labeled with an identifying number, and sealed.

In both cases, the sample number is documented on the chain of custody form. The sample location may be photographed with a sample photo identification card in the focus area documenting the sample number and date, and orienting the viewer to the sample location with an arrow.

Intrusive media sampling (i.e., coring, scraping, etc) for Be will be unlikely to be necessary unless the media will be disturbed during decommissioning, removal, or demolition of structures in such a way that worker exposure is likely, or unless the contamination is suspected to be due to the P-listed, RCRA-regulated Be powder.

Special considerations for beryllium powder

In rare instances, the RCRA-regulated, P-listed Be powder may be suspected as a contaminant. If sufficient documentation exists to demonstrate that any Be contamination in a given area is likely to be in the form of Be powder, the material will be treated as RCRA waste and subject to treatment standards under 40 CFR 268.40, or else RFETS will propose release criteria for the material based upon surveys and available information. If TCLP analyses are performed, a minimum of three samples and a duplicate shall be taken by the appropriate method described in Section 5.1.2.

4.4 Polychlorinated Biphenyls

Historical data such as maintenance records, specifications, and emergency response documents will be consulted to determine if processes involving PCBs or potentially PCB-containing substances were carried out in the area being characterization. Particular attention will be paid to records of spills.

A physical tour of the building, entering every physically accessible area and room, will be undertaken, and notice taken of any evidence of spills or staining, electrical equipment, hydraulic equipment, or other evidence of potential PCB contamination. A list will be generated, along with estimated quantities. IH will evaluate individually any situation involving sampling of PCBs or potential PCB-containing materials and will ensure that proper worker protection is achieved.

4.4.1 Identification and Location of Samples

Decisions as to whether sampling of various materials is required will be based in part on the designated waste stream, in addition to IH concerns regarding worker safety. Federal regulations regarding characterization of a potential PCB waste stream are complex and are governed by the classification of the waste. A building walkdown will be conducted to assess types of materials potentially containing PCBs, which include but are not limited to the following:

- Hydraulic fluid
- Oils
- Transformers
- Capacitors
- Fluorescent light ballasts
- Gaskets in potential PCB-containing systems
- Paints, coatings, and sealants
- Areas of a known or suspected PCB spill, or staining near a PCB-containing system.

Although the building slab is not within the scope of RLC, any floor surfaces above the ground floor or other elevated surfaces that are not part of the slab should be sampled. Additionally, locations of spills or potential contaminations of the slab noted during walkdown should still be noted for use during later phases of characterization.

Following the building walkdown, PCBs will be categorized into the classifications outlined insubsequent sections. Where doubt exists as to the potential classification of a type of PCB-containing material, 40 CFR 761 will be consulted directly.

4.4.1.1 PCB Bulk Product Waste

Some materials may be classified as PCB Bulk Product Waste, which is defined as waste derived from manufactured products containing PCBs in a non-liquid state and at a concentration at time of designation for disposal of greater than or equal to 50 ppm. These materials need not be sampled as long as restrictions outlined in 40 CFR 761.62 regarding their disposal are met. These materials and restrictions include but are not limited to:

- Applied dried paints, coatings, and sealants are acceptable for disposal (with notification) in a non-hazardous solid waste landfill as PCB Bulk Product Waste under 40 CFR 761.3 and 40 CFR 761.62 paragraph (b);
- Fluorescent light ballasts containing PCBs in the potting material are segregated from those that do not, and all are sent offsite for recycling. However, the 95% upper confidence limit of the mean value of a representative sample set cannot exceed 50 ppm in material to be sent for recycling. This determination can be made via process knowledge or laboratory analysis. If they are not to be recycled, PCB-containing ballasts must be disposed of as described in 40 CFR 761.62.

4.4.1.2 PCB Remediation Waste

Buildings where PCB use occurred, but for which there are adequate inspection records, operational records, and administrative records that indicate no PCB spill has occurred, or if such did occur, was cleaned up to meet standards in 40 CFR 761 through 766, need not be sampled. Additionally, if PCB spills are known or suspected on a building slab, or on a ground floor which is functionally equivalent to the building slab, sampling will be outside the scope of reconnaissance level characterization and will be the responsibility of environmental Restoration (ER).

In situations within the scope of RLC for which adequate data do not exist, a small-scale survey will be performed, with three judgment samples and a duplicate taken at locations biased toward probable contamination areas.

If such surveys indicate PCB contamination, or if a PCB spill is discovered that has not been cleaned up, the area will be treated as directed by the most recent versions of 40 CFR 761 through 766, the on-site PCB Program Management Plan, and the WSRIC standards.

Process knowledge and historical documentation are vital for this process, since decision thresholds vary depending upon the date of the spill. For example, the criteria for PCB remediation waste (i.e., potentially containing PCBs from historical releases; defined by 40 CFR 761.3), include:

- Materials where the original source was ≥ 500 ppm PCB beginning on April 18, 1978, or ≥ 50 ppm PCB beginning on July 2, 1979;
- Materials disposed of prior to April 18, 1978, that are currently at > 50 ppm PCBs regardless of the concentration of the original spill.

If material meets the definition of PCB remediation waste, the free-release concentration is <1 ppm PCBs as determined in accordance with requirements of §761.61, Subpart G. Higher release levels for PCB remediation wastes are permissible, but carry specific restrictions on disposition of the material.

Sampling of the area will likely include application of the Midwest Research Institute grid procedure described in *Verification of PCB Spill Cleanup by Sampling and Analysis* (EPA-560/5-85-026) and *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup* (EPA-560/5-86-017).

The number of samples required by this procedure will depend upon the size of the spill area, and the documents above should be consulted for exact requirements concerning hexagonal grid designs, layout for irregularly shaped areas, number and spacing of samples, etc. In general, for a sampling area of ≤ 50 ft^2, 7 samples are required; for 51 to 400 ft^2, 19 samples are required; and for > 400 ft^2, 37 samples are required.

Additionally, for purposes of decontamination or removal, PCB remediation waste must be further categorized into: non-porous surfaces, porous surfaces, liquid, and bulk PCB remediation waste (which includes soil and sludge and is not to be confused with PCB bulk product waste), as per 40 CFR 761.61.

4.4.1.3 PCB Items

A PCB Item is defined as any PCB article, PCB article container, PCB container, PCB equipment, or anything that deliberately or unintentionally contains or has as a part of it any PCBs, and includes transformers and capacitors. If encountered within the scope of RLC, these will be characterized prior to disposal based upon the PCB content detected in the dielectric fluid, or on surface swipes.

4.4.1.4 Other PCB Wastes

While less likely to be encountered during RLC, other classes of PCB waste exist and should be recognized if encountered.

PCB liquids include PCB-containing transformer oils and hydraulic oils. If encountered within the scope of RLC, the PCB concentration will be determined prior to disposal as per 40 CFR 761.50 and 761.60.

PCB radioactive waste refers to PCBs that also contain source, special nuclear, or byproduct material subject to regulation under the Atomic Energy Act of 1954, as amended, or naturally-occurring or accelerator-produced radioactive material. This waste will be managed in accordance with 40 CFR 761 per the requirements of the specific category of radioactive waste.

PCB research and development waste includes wastes generated as a result of chemical analysis of PCBs and related research and development, and is not expected to be encountered in RLC.

4.4.2 Media Sampling

The following sampling techniques will generally be applied to PCB sampling subject to stipulations in the most recent versions of 40 CFR 761 through 766, the on-site PCB Program Management Plan, and the WSRIC standards. These as well as the EPA documents *Verification of PCB Spill Cleanup by Sampling and Analysis* (EPA-560/5-85-026) and *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup* (EPA-560/5-86-017) should be consulted in detail before any sampling begins. In general, the following standards apply to PCB media sampling:

- For non-porous surfaces, wipe sampling of a sampling area of 100 cm^2 will be carried out utilizing a gauze pad or filter paper moistened with a suitable solvent (generally hexane). The gauze or filter is immediately placed in a glass bottle and sealed after the wipe is taken. Sampling kits are available for this procedure.
- For porous surfaces within the scope of RLC into which a PCB spill could migrate, coring will be used as described in EPA-560/5-86-017.

To assess material/media against the appropriate regulatory threshold for PCB-contaminated media (40 CFR 761.125), a laboratory method will be used to quantify PCB concentrations. The SW-846 analytical Method 4020 *Screening for PCBs by Immunoassay* is appropriate for non-aqueous liquids (or soils), whereas Method 8082 *PCBs by Gas Chromatography* is recommended under other circumstances.

The analytical method will have a practical quantitation limit (PQL) of less than 50% of the regulatory threshold which applies to the particular type of waste. Methods 4020 and 8082 satisfy this criterion.

4.5 Asbestos

All surfacing material and thermal insulation materials potentially containing asbestos **SHALL** be sampled for asbestos per 40 CFR 763.86 and 5 CCR 1001-10 by a Certified Asbestos Inspector. The presence of asbestos (i.e., greater than 1% by volume) **SHALL** be determined at an offsite, certified laboratory with asbestos accreditation (NIST and NVLAP) by method EPA 600/R-93/116. Point counting will be required when polarized light microscopy (PLM) results on asbestos range between 0 and 1%. All offsite laboratory contractual and quality specifications are under the auspices of the RFETS Analytical Services Division.

Building records (such as blueprints and specifications) will be consulted for documentation of use of asbestos in construction or remodeling of the building under characterization. Maintenance and asbestos abatement records, blueprints, as-built drawings, specifications, and emergency response documents are examples of the data used.

A physical tour of the building, entering every physically accessible area and room, will be undertaken, and notation made of suspect or affected materials that indicate through either historical data or the asbestos inspector's experience the presence of asbestos in building materials. A list will be generated that includes estimated quantities. A Certified Asbestos Inspector may assume that a material is asbestos until proven otherwise.

4.5.1 Identification and Location of Samples

Sample locations are selected randomly according to how each represents a homogeneous material. Since homogeneous areas are located throughout the building, the representation and number of samples is the driving factor rather than exact location of the sample in each room. The generic categories of materials to be sampled for asbestos are listed below:

- Thermal systems (e.g., pipe insulation)
- Surfacing materials (e.g., fireproofing, ceiling texture)
- Miscellaneous (e.g., floor tiles, ceiling panels).

Non-suspect (or unaffected) materials are those traditionally made of wood, glass, or metal. However, the inspector will suspect the adhesives that have been applied to secure non-suspect materials to the substrate.

The number of samples for asbestos for each homogeneous area is outlined in EPA 40 CFR 763.86. This section of the Asbestos Hazard Emergency Response Act (AHERA) provides requirements for asbestos building inspections. Sample quantity will be decided first by a material's physical condition of friability, then by its general category. Friable materials are those that are capable of being crumbled or reduced to powder by hand pressure.

Thermal systems insulation, such as that found on pipes or ducts, friable or non-friable, requires a minimum of three samples per homogeneous area, one sample from patches less than six linear or square feet (lf or ft^2), and one from cementitious or "mudded" fittings. Each mechanical system, such as hot and cold domestic water, may have several homogeneous areas. Each will be sampled accordingly.

Only friable surfacing materials, such as fire-proofing or ceiling texture, will have a nine-section grid applied to a blueprint of the area and samples will be acquired from the center of randomly selected grids. If the homogeneous area of friable surfacing material is less than 1,000 ft^2, three samples are needed; if between 1,000 and 5,000 ft^2, five samples are needed; if the area is over 5,000 ft^2, seven samples are needed. Grid spacing is only required for friable surfacing materials which may include drywall joint compound if suspected by the inspector.

Miscellaneous materials, such as floor and ceiling tiles or cementitious board ("Transite") will be sampled according to the inspector's discretion, as outlined in EPA 40 CFR 763.86 (c&d). For the purpose of this survey and based on the inspector's experience and discretion, a minimum of one sample of each suspected material in this category will be acquired.

Sampling for asbestos in building materials is a destructive method that may release a small quantity of dust. Although material samples are to be collected from inconspicuous areas, proper safety precautions must be taken to prevent the spread of suspect materials.

Settled dust sampling for asbestos will be used as an optional aid to assessment of IH issues such as work practices and engineering controls and PPE that would be used in the decommissioning, removal or demolition of structures.

4.5.2 Media Sampling

Bulk sampling for asbestos is performed using destructive techniques and requires the collection of a representative sample of the material down to the substrate. Each sample must contain a minimum of one cubic centimeter of material to facilitate analysis and archival processes. Each sample will be acquired with the intent of assuring the quality, representation and safety of the process.

For bulk sampling, a polyethylene drop cloth or plastic bag is placed below the elevated sample areas, and the immediate sample area is dampened with a mist of water and surfactant. A sampling tool, such as a hammer and chisel, razor knife, or hole saw is selected, and the sample is collected down to the level of the substrate. During this process, the immediate surface is misted as necessary.

The acquired sample is placed in a sealable container, the container is sealed, and a pre-numbered label is placed on the container. The sample number label is placed on chain of custody papers and the container is verified to be sealed. The sampling tool is thoroughly cleaned using mister and wipes as per AHERA, and the sample area is patched as needed.

The description and location is documented on a form, a sample label is placed on the form, and the location is documented on a blueprint, sketch or drawing of the area. The sample container, drop cloth and immediate sample area are wet wiped and the drop cloth is carefully folded in to the center and placed in a bag, and the bag is sealed.

In the case of routine maintenance areas, a pre-numbered label is placed at the sample location. Labels may be placed on all sample locations. The sample location may be photographed with a sample photo identification card in the focus area documenting the sample number and date, and orienting the viewer to the location with an arrow. All used wipes, drop cloths, and PPE will be added to the appropriate waste stream.

Dust sampling on horizontal surfaces will be sampled using a micro-vac technique that requires the use of a template that isolates a 10 square inch pattern. The sampling tool is a low volume battery powered air sampling pump calibrated at >2 liters per minute with a 25 mm MCE filter media cassette attached. A two-inch section of Tygon tubing is attached to the upstream side of the cassette and facilitates pickup of all loose dust in the grid area. Each sample is documented as to location, the cassette is labeled with an identifying number, and sealed. The sample number is documented on the chain of custody form. As above, the sample location may be photographed with a sample photo identification card in the focus area documenting the sample number and date, and orienting the viewer to the sample location with an arrow.

5.0 RADIOLOGICAL FIELD INSTRUMENTATION

For RLC, existing site instrumentation and techniques can be used to achieve the DQOs. However, other instrumentation may be proposed and used if approved by D&D Closure Projects.

5.1 Detector Descriptions

Initial characterization for beta-gamma emitters may be performed using *in situ* gamma spectroscopy, using existing instruments and procedures, i.e., NaI(Tl) detector (FIDLER or equivalent). This characterization is to qualify the area for elimination of various isotopes. This will not be necessary for class 1 areas because the automatic counting instrument surveying for alpha contamination during the final status survey will at the same time identify whether there is a need to recount for beta-gamma contamination.

Portable instrument surveys will be performed using the NE Electra with a DP6-BD dual scintillation probe or equivalent. Efforts are underway to add a database capability to the existing instrumentation or to substitute instrumentation that will automatically record location and measurement data. Automatic recording instruments are to be used in lieu of manual recording of survey data whenever possible. Swipes for removable contamination will be counted on the Tennelec low level alpha-beta system or equivalent. Equivalency in all cases will be determined by D&D Radiological Engineering personnel and documented appropriately. Instrumentation summaries are provided in Table 6-1.

5.2 Detection Sensitivities

The detection sensitivity of any measurement system refers to a radiation level or quantity of radioactive material that can be measured or detected with some known or estimated level of confidence. This quantity is a factor of both the instrumentation and the technique or procedure being used. The primary parameters affecting the detection capability of a radiation detector are the background count rate, the detection efficiency of the detector, and the counting time interval. It's necessary to use actual background count rate values and detection efficiencies when determining counting and scanning parameters. When making field measurements, the detection sensitivity will be less than that achievable in the laboratory due to increased background, a lower detection efficiency, and human factors. Detection sensitivity can be improved by selecting an instrument with a higher detection efficiency or a lower background, increasing the count time (decreasing the scanning speed), or increasing the effective size of the probe without significantly increasing the background response.

Table 5-1 Instrumentation Summary

Instrument	Detector Type	Application	Typical MDC	Comments
NE Electra w/ DP6 probe	ZnS & plastic scintillation	Alpha-beta manual surveys	42 dpm/100 cm^2 α 382 dpm/100 cm^2 β 1207 dpm/100 cm^2 β	Direct measure [a] Direct measure [b] Manual scan [b]
Bicron FIDLER	NaI(Tl) scintillation	Directional γ & x ray detection on large surfaces	1055 dpm	Assumed background is 2000 cpm [c]
Eberline SAC-4	Scintillation phosphor	Alpha measurement	20 dpm	Background 0.63 cpm; efficiency 0.33
Eberline BC-4	Shielded GM	Beta-gamma measurement	200 dpm	Background 94.9 cpm; efficiency 0.24
Tennelec	Gas-flow proportional	Alpha-beta measurement	Determined for each sample group	See note d
Analytical lab	Gas-flow prop.	Gross alpha	0.3 pCi/g max.	
Analytical lab	Gas-flow prop.	Gross beta	0.6 pCi/g max.	

a. Does not include 0.25 source efficiency
b. Does not include 0.5 source efficiency
c. Two times background (4000 cpm) indicates radioactivity present in a known radiological area; for surveys not in a known radiological area, radioactivity is considered present when the measured values equal background + 2 × $\sqrt{\text{background}}$; average efficiency is 0.20.
d. Background ≤1 cpm, efficiency 0.31 to 0.396 alpha; background ≤10 cpm, efficiency 0.40 to 0.50 beta

Survey costs are approximated as follows:

Survey Type	Cost per Survey ($)
Direct measurement: alpha	5
Beta	5-10
FIDLER	10-20
Tennelec	30-50
HPGe [a]	100-200
Scan (per square meter): automatic	5-50
Manual	50-350

a. No existing on-site portable instrumentation or procedures.

5.3 Minimum Detectable Concentration (MDC) Calculations

The critical level, L_c, is the net response level, in counts, at which a detector output can be considered above background. The MDC, in units of activity for a given area or volume, is the net radioactivity above the critical level that an instrument can be expected to detect 95 percent of the time. This is the value used to indicate the detection capability of an instrument. The

MDC should not be underestimated, since this can result in release of material that exceeds a release limit.

5.3.1 Direct Measurement MDCs

For contamination detection instruments, in a stationary mode (e.g., Eberline BC-4, SAC-4, NE Electra, etc.), use the following equation to determine the minimum detectable concentration:

$$MDC = \frac{2.71 + 3.29\sqrt{R_b\, t_g \left[1 + \left(\frac{t_g}{t_b}\right)\right]}}{eff\; t_g\; k}$$

where MDC = minimum detectable concentration
R_b = background count rate (cpm)
t_g = gross count time (minutes)
t_b = background count time (minutes)
eff = efficiency (c/d)
k = correction and conversion factors.

5.3.2 Scan Measurement MDC for Beta-Gamma Surveys

For a given probe area (100 cm^2 for the DP6-BD probe), the MDC is based on the minimum detectable count rate (MDCR) and instrument, surface, and surveyor efficiencies.

$$MDCR = d'\sqrt{b_i}\left(\frac{60}{i}\right)$$

where: d' = sensitivity index based on a correct detection rate and tolerance for false positives. For a continuous scan, these values are 90 percent and 10 percent, respectively, and d' equals 2.65.

b_i = the average number of background counts in the observation interval, i.e., $b_i = b\left(\frac{i}{60}\right)$ and b = background for one minute

i = the time interval during which the source is under the active area of the probe. This is assumed to be 1 s.

$$\text{Scan MDC} = \frac{MDCR}{\sqrt{e_{hf}}\; eff\left(\frac{A}{100}\right)c}$$

where e_{hf} = human factors efficiency, assumed to be 0.65.

eff	=	instrument efficiency
A	=	probe area
c	=	other conversion factors.

5.3.3 Scanning for Alpha Emitters

Since the time a contaminated area is under a probe varies and the background count rate of alpha instruments is typically less than 1 cpm, it isn't practical to determine a fixed alpha MDC for scanning. Instead, the probability of detecting an area of contamination is determined for a given scan rate. This assumes that a single count will cause the surveyor to stop and investigate further.

$$P_{n\geq 1} = 1 - e^{\frac{-GEd}{60\,v}}$$

where	P	=	probability of observing at least one count
	G	=	contamination activity, release limit in dpm
	E	=	detector efficiency (4π)
	d	=	width of detector in direction of scan in cm
	v	=	velocity of scan in cm/s.

When a count is detected, then stationary measurements are performed, and the MDC in Section 6.3.1 applies.

5.4 Calibration and Maintenance

Instrument calibration and maintenance is critical because it affects the sampling results. Calibratic/maintenance frequency is often established by the equipment manufacturer.

5.4.1 Calibration

Radiological instrument calibrations must meet the following criteria:

- Meets the requirements contained in ANSI N323 for radiological instrumentation calibration.
- Calibrations must use National Institute of Standards and Technology (NIST) traceable sources.
- Calibration procedures must be used for each radiological instrument type and will include frequency of calibration, precalibration requirements, primary calibration requirements, periodic performance test requirements, calibration record requirements, and maintenance requirements.
- Functional tests are to be used to assess instrumentation designs that include alarms or that involve a process control. Functional tests must test all components involved in an alarm or trip function and performed at least annually.
- In unusual and limited situations it may be necessary to use an instrument in an

application other than that envisioned by the manufacturer. Special calibrations are to be performed for use of instrumentation outside manufacturer's specifications. In such cases, the instrument is to be adjusted, calibrated, and labeled to identify the special conditions and used only under the special conditions for which it was calibrated.

- Instruments are to bear a label or tag with the date of calibration and date calibration expires.
- Instruments whose "as found" readings indicate that the instrument may have been used while out of calibration are to be reported to the Radiological Control organization. The Radiological Control organization will review surveys performed with the instrument while it was out of calibration.

5.4.2 Maintenance

A program for preventive and corrective maintenance of radiological instrumentation must be established and documented. Preventive and corrective maintenance are to be performed using components and procedural recommendations at least as stringent as those specified by the manufacturer of the instrument. Radiological instruments must undergo calibration prior to use following any preventive or corrective maintenance or any adjustment that voids the previous calibration. A battery change is not normally considered maintenance.

5.4.3 Calibration Facilities

Calibration facilities must perform inspections, calibrations, performance tests, calibration equipment selection, and quality assurance in accordance with the recommendations of ANSI N323 and take the following actions:

- Locate activities in a manner to minimize radiation exposure to operating personnel and to personnel in adjacent areas.
- Minimize sources of interference, such as backscatter and non-ionizing radiation, during the calibration of instrumentation, and correct for interference as necessary.
- Operate in accordance with the referenced standards.
- Generate records of calibration, functional tests, and maintenance in accordance with the referenced standards.

5.4.4 User Requirements

Return instruments to the Instrument Repair and Calibration Facility if any of the following conditions exist:

- Instrument is due for calibration.
- Instrument is physically damaged.
- Instrument fails performance test or operational check.
- Instrument is malfunctioning or responding abnormally.
- Instrument requires maintenance beyond what is specified on the Instrument Technical Specification Sheet.

Report in writing to the Instrument Repair and Calibration Facility any change in an instrument status such as:

- Instrument is disposed of, declared surplus, or declared excess.
- Instrument is lost or destroyed.
- Instruments used for monitoring and contamination control must be :
- Periodically maintained and calibrated on an established frequency of at least once per year
- Appropriate for the type(s), levels, and energies of the radiation(s) encountered
- Appropriate for the existing environmental conditions
- Routinely tested for operability.

6.0 LABORATORY ANALYSIS

Analysis of RLC samples will be performed by laboratories managed by the RFETS Analytical Services Division. Laboratories will perform work pursuant to requirements presented in the RFETS Statement of Work (SOW) for Analytical Measurements. This SOW defines requirements for the analysis of various parameters, including radiochemical, organic and metal, in samples collected at or related to the site. The SOW is composed of several modules. The General Laboratory Requirements Module, GR01, provides general technical and administrative requirements common to all analyses performed for the site. The General Requirements for Electronic Data Deliverables Module, GR02, provides requirements for the electronic delivery of data. Other SOW modules provide parameter-specific analytical, quality assurance/quality control, reporting, and general requirements specific to stated analytical tasks.

Where possible, SOW modules incorporate industry standard methods and protocols by reference. In some cases, requirements in these referenced methods are augmented or clarified by SOW modules. Typical references include EPA Contract Laboratory Program Statements of Work, EPA Test Methods for Evaluating Solid Waste (SW-846; EPA 1986), EPA methods for wastewater monitoring, and ASTM methods.

7.0 DATA ANALYSIS AND QUALITY ASSESSMENT

Radiological data needs to first be reduced to perform comparisons with radiological limits. The quality of this transformed data then needs to be assessed to assure that the data can be used for the RLC.

There are three types of radiological surveys/samples that will be assessed in this section: removable surface contamination (RSC) surveys, total surface contamination (TSC) surveys and media samples. The text will explain how radiological survey results are transformed from a gross instrument count to a net activity that can be used for comparisons with radiological limits. For media samples, the method for transforming a gross laboratory result to a net concentration of radioactive material will be discussed. The use of background survey/sample results will also be discussed.

The radiological limits or $DCGL_W$ will then be delineated for both surface contamination surveys and media samples. The $DCGL_W$ is the level below which areas are considered sanitary waste or may be free released. The $DCGL_{EMC}$ is the maximum level below which areas are considered sanitary waste or may be free released. Areas that result in measurements in excess of these levels will be further evaluated during IPC.

Finally, methods for assessing the quality of the radiological sample data will be discussed. Methods will be discussed on data validation, data verification, data quality indicators and data quality assessment.

7.1 Conversion of Radiological Measurements to Reporting Units

Radiological survey/sample results need to be converted from a gross count to a net concentration for the purpose of comparing with radiological limits. For surface contamination surveys, the radiological limits are prescribed in dpm/100cm^2. For media samples, the radiological limits can be based on a surface contamination limit in dpm/100 cm^2, a volumetric limit based on the MDC of the counting instrument, or a volumetric limit based on the 95 % confidence limit of the background range, if applicable.

The data conversion for surface contamination (total and removable) measurements will be performed in accordance with RSP 7.02. The data conversion for samples will also be performed in accordance with an approved RSP (based on the equation provided in Section 8.1.3).

7.1.1 Removable Surface Contamination

RSC results will be compared with an RSC limit ($DCGL_W$) that has the units of dpm/100 cm^2. RSC is measured in the field using a swipe technique that assesses the amount of loose radiological contamination over a 100 cm^2 area. Swipes will be counted for both alpha and beta-gamma-emitting radioactive material. Swipes are counted using fixed counting equipment to see how much loose radioactive material transferred to the swipe. The RSC net result is calculated per RSP 7.02.

7.1.2 Total Surface Contamination

TSC results will be compared with a TSC limit that has the units of dpm/100 cm^2. Total surface contamination is measured in the field using portable radiation detection instrumentation. The probe from this instrumentation is placed next to an area where radioactive material may be present. Both alpha and beta-gamma-emitting radioactive material may be counted by the instrumentation.

The local area background (LAB) is subtracted from the instrument gross count rate. This subtraction is necessary since the surface contamination limits apply to the radioactive material present above background. If background were not subtracted from the instrument net count rate, the instrument gross count rate would be an overestimate of the amount of radioactive material present.

If a beta/gamma survey is performed which results in the presence of Naturally Occurring Radioactive Material (NORM), then an additional option exists in which a statistically-based background value is determined. This reference background is then subtracted from the gross data result. The total surface contamination result is calculated per RSP 7.02.

7.1.3 Media and Volumetric Contamination

Media and volumetric contamination samples are analyzed with the same methods and the results will be reported in pCi/gr. The use of the word "media" in the following section also refers to volumetric samples.

The media contamination results can be analyzed in one of two different ways. The media results can be compared with surface contamination limits in dpm/100 cm^2, or with MDC of the counting instrument (per the requirements in the RFETS NRA Waste Verification Program).

The first method described above is performed by converting the media sample results to a dpm/100 cm^2 value. This value is then compared with the TSC limit that has the units of dpm/100 cm^2. The media sample in pCi/gram is converted to a dpm/100cm^2 value through the following equation:

$$TSA = \frac{SR * SW * 2.22}{SA}$$

where:

TSA= Total Surface Contamination (dpm/100cm^2)
SR = Sample Result (pCi/gram)

SW	=	Sample Weight (grams)
2.22	=	Conversion factor from pCi to dpm
SA	=	Sample Area (cm^2).

If the data result for the media being analyzed indicates the presence of NORM that is also a site contaminant of concern (e.g., U-238), then an additional comparison option exists in which a statistically based background value is determined. The sample result can then be compared with the 95% confidence limit of the background for the media.

7.2 Comparison with Radiological Limits

The comparison of the measurement results against the DCGL values, as described in this section, provide the initial input to D&D planning, including initial waste volume estimates, areal extent of contamination, decontamination methods, etc. Thus, the conclusion reached during RLC are subject to further evaluation during IPC.

7.2.1 Surface and Media Contamination Limits

The $DCGL_W$ limits are based on the requirements in DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. Surface contamination limits are based on Figure IV-1, *Surface Contamination Guidelines* from DOE Order 5400.5 as amended by DOE Memorandum entitled *Application of DOE 5400.5 requirements for release and control of property containing residual radioactive material*, dated 11/17/95. The surface contamination limits to be used at RFETS are provided in Table 7-

If media sample results will be converted to a dpm/100 cm^2 value, the converted sample result will be compared with the "Total Average" surface contamination limit above. If media sample results will be compared with the MDC of the counting instrument, the sample result will be compared with the MDC reported for the sample result. In the event that the media sample results will be compared with a background concentration, the sample result will be compared with the mean plus two standard deviations of the background data set.

7.2.2 Data Quality Objectives Support

To support the requirements in the DQOs for radiological waste classifications, the following initial assumptions are applicable:

1. All areas and their contents are not radiologically posted or posted as Radiological Buffer Areas or Radioactive Material Areas may be considered sanitary waste or free releasable.
2. All areas and their contents that are radiologically posted as Contamination Areas or Fixed Contamination Areas may be considered LLW.
3. All areas and their contents that are radiologically posted as High Contamination Areas or Airborne Radioactive Areas may be considered LLW or TRU waste.

7.2.3 Comparison With Surface Contamination Limits

To compare the survey result with the $DCGL_W$, the identity of the radionuclides in an area must first be determined. The applicable "average total," "maximum total" and "removable" surface contamination limits can then be taken from Table 7-1. These surface contamination limits are used for all TSC and RSC survey points. Both TSC and RSC survey results need to be assessed to disposition an area.

The comparisons performed in this section are to provide input on the initial D&D plans and methods, and therefore do not include discussion of restricted release or recycling.

At each survey point, the survey result for total contamination will be compared directly with the average TSC limit. If all survey results are below the average TSC limit, the area may be categorized as sanitary waste or free released. If any survey result is greater than the maximum TSC limit, the affected area will be categorized as LLW. If any survey result is greater than the average TSC but less than the maximum TSC limit, the 1 m^2 area around the survey point may be averaged for comparison purposes with the average TSC limit.

At each survey point, the survey result for RSC will be compared directly with the RSC limit. If all survey results are below the RSC limit, the area may be categorized as sanitary waste or free released. If any survey result is greater than the RSC limit, the area around that survey point will be categorized as LLW.

7.2.4 Comparison With Sample Contamination Limits

Sample (media or volumetric) results will be compared with the surface contamination limits in dpm/100 cm^2, the MDC of the counting instrument, or the 95% confidence limit of the background for the media, if applicable. It is only necessary to apply one of the following comparisons when assessing media samples:

1. At each sample point, the sample result in dpm/100 cm^2 will be compared directly with the Average Total Surface Contamination limit. If all sample results are below the Average Total Surface Contamination limit, the area may be categorized as sanitary waste or free released. If any sample result is greater than the Maximum Total Surface Contamination limit, the area around that sample point will be categorized as LLW.
2. At each sample point, the sample result will be compared directly with the MDC of the counting instrument. If all sample results are below the MDC of the counting instrument, the area may be categorized as sanitary waste or free released. If any sample result is greater than the MDC of the counting instrument, the area around that sample point will be categorized LLW.
3. At each sample point, the sample result will be compared directly with the mean plus two standard deviations of the background data set. If all survey results are below the mean plus two standard deviations of the background data set, the area may be categorized as sanitary waste or free released. If any sample result is greater than the mean plus two standard deviations of the background data set, the area around that sample point will be categorized as LLW.

Table 7-1 Surface Contamination Guidelines

Radionuclides 2/	Total Average 3/ 4/ (dpm/100 cm2) 1/ (DCGL$_w$)	Total Maximum 4/ 5/ (dpm/100 cm2) (DCGL$_{emc}$)	Removable 4/ 6/ (dpm/100 cm2) (DCGL$_w$)
Transuranics, I-125, I-129, Ra-226, Ac-227, Ra-228, Th-228, Th-230, Pa-231	100	300	20
Th-Natural, Sr-90, I-126, I-131, Ra-223, Ra-224, U-232, Th-232	1,000	3,000	200
U-Natural, U-235, U-238 and associated decay products, alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. 7/	5,000	15,000	1,000
Tritium (applicable to surface and subsurface.	Not Applicable	Not Applicable	10,000

1/ As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

2/ Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

3/ Measurements of average contamination should not be averaged over an area of more than 1 . For objects of less surface area, the average should be derived for each such object.

4/ The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

5/ The maximum contamination level applies to an area of not more than 100 cm2. DOE 5400.5 Chg 2 IV-7

6/ The amount of removable material per 100 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

7/ This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

8/ Property recently exposed or decontaminated, should have measurements (smears) at regular time intervals to ensure that there is not a build-up of contamination over time. Because tritium typically penetrates material it contacts, the surface guidelines for Beta-Gamma emitters are not applicable to tritium. The DOE has reviewed the analysis conducted by the DOE Tritium Surface Contamination Limits Committee ("Recommended Tritium Surface Contamination Release Guides," February 1991), and has assessed potential doses associated with the release of property containing residual tritium. The DOE recommends the use of the stated guideline as an interim value for removable tritium. Measurements demonstrating compliance of the removable fraction of tritium on surfaces with this guideline are acceptable to ensure that non-removable fractions and residual tritium in mass will not cause exposures that exceed DOE dose limits and constraints.

7.3 Comparison with Chemical Limits (Decision Rules)

Lead and Other RCRA Metals

The maximum levels of contamination for the toxicity characteristic as specified in 40 CFR 261.24 are given below:

Contaminant	Regulatory Level (mg/L)
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0

Volatile Organic Chemicals

Results will be compared to the Action Levels set by the RFCA (Attachment 5, "RFETS Action Levels and Standards Framework for Surface Water, Ground Water, and Soils"). If media exceed RCRA TCLP contamination thresholds as listed in 40 CRF 261.24, they will be managed according to RCRA requirements.

Beryllium

If detectable Be contamination can be shown through process knowledge to consist of Be powder (P015 under RCRA), then the contaminated materials will be treated as RCRA waste and subject to treatment standards under 40 CFR 268.40, or else RFETS will propose release criteria for the material based upon surveys and available information. Likewise, if Be in any form is identified such that it fits the criteria for an underlying constituent, it will be subject to Universal Treatment Standards as in 40 CFR 268.48.

For all other situations, if concentrations of Be in surface samples are equal to or greater than 0.2 $\mu g/100\ cm^2$, the material is considered Be-contaminated but is not subject to RCRA. It will be labeled "Beryllium Waste" in accordance with the CBDPP, and levels compared to the waste acceptance criteria of the disposal site to which it will be transported.

Polychlorinated Biphenyls

If materials are classified as "PCB Bulk Product Waste," sampling is not required and material can be disposed of as stipulated in 40 CFR 761.3 and 40 CFR 761.62. For samples taken from areas where a spill was suspected or confirmed, the most recent versions of 40 CFR 761 through 766, the on-site PCB Program Management Plan, and the WSRIC standards must be consulted for the applicable decision threshold. In general, for materials contaminated due to a PCB spill after July 2, 1979, if the 95% upper confidence limit (UCL) of the mean value of the sample set exceeds 50 ppm or other applicable RFCA document decision threshold, then the associated material is considered TSCA waste.

Asbestos

If any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e., greater than 1% by volume), then material is considered ACM; otherwise, the material is considered non-regulated ACM (per 40 CFR 763 and 5 CCR 1001-10). Industrial Hygiene and Safety practices are required for any ACM regardless of percent content per OSHA regulations.

7.4 Data Assessment

An assessment of the nonradiological data collected during RLC will be performed to assure that the data satisfies the objectives of the RLCP. The assessment involves three phases: verification, validation, and data quality assessment (DQA).

A graded approach will be applied to the data assessment phase, based on the type of data being assessed. Nonradiological data is subject to a higher degree of data assessment due to the fact that the data collected during the RLC phase will generally serve as the final indicator of the nonradiological status of a structure or facility (see Section 11.0, References). In contrast, the RLC radiological data is utilized to evaluate the initial radiological status of a structure and facility, and will not serve as Pe-Demolition Survey data; Therefore, a lesser degree of assessment is required.

7.4.1 Data Verification

Data verification ensures that the requirements stated in the planning documents (e.g., RLCP, Radiation Safety Practices procedures) are implemented as prescribed. This means that deficiencies or problems that occur during implementation should be documented and reported. In addition, analytical and radiochemical samples are subject to the following reviews:

- Chain-of-Custody was implemented during sampling and analysis.
- Preservation and hold-times were within tolerance.

7.4.2 Data Validation

Data validation activities ensure that the results of data collection activities support the objectives of the RLC, or support a determination that these objectives should be modified. Data usability is the process of ensuring or determining whether the quality of the data produced meets the intended use of the data. Data verification compares the collected data with the prescribed activities documented in the RLCP and the Radiological Safety Practices procedures. Data validation is often defined by six data descriptors:

1. Reports to decision maker

2. Documentation
3. Data sources
4. Analytical method and detection limit
5. Data review
6. Data quality indicators

The decision maker or reviewer examines the data, documentation, and reports for each of the six data descriptors to determine if performance is within the limits specified in the RLCP developed during survey planning. Data collected should meet performance objectives for each data descriptor. If they do not, deviations should be noted and any necessary corrective action performed. Corrective action should be taken to improve data usability when performance fails to meet objectives.

Formal validation of analytical data shall be performed at the following frequencies:

- ≤ 20 samples - 100%
- > 20 samples - 25%

The frequencies are established because 1) typical analytical batching is ≤ 20 samples each, 2) data packages are validated by sample batch, and 3) representativeness percentages may be difficult to justify with less than 20 samples.

7.4.2.1 Reports to Decision Maker

The cognizant individuals who will be performing the D&D planning including decontamination methods, schedules, budgets, etc. will be appropriately informed of the previous and current status of the area being characterized.

7.4.2.2 Documentation

The documents to be assessed are the completed RLC survey package and nonradiological characterization package, including the completed radiological survey forms and results, the final radiological sample data, nonradiological data, data handling records (e.g. chain-of-custody forms), and supporting documentation.

7.4.2.3 Data Sources

Data source assessment involves the evaluation and use of historical analytical data. Historical analytical data will be evaluated for use before RLC surveys/samples are obtained. The use of historical analytical data will be evaluated with respect to RLCP requirements.

7.4.2.4 Analytical Method and Detection Limit

The selection of appropriate analytical methods based on detection limits is important to survey/sample planning. The method detection limit directly affects the usability of the data because results near the detection limit have a greater possibility of false negatives and false positives. Results near the detection limit have increased measurement uncertainty. All reported RLC data must provide or reference the basis for the calculated detection limit (MDC or equivalent).

For the radiological RLC surface contamination surveys/samples, the detection limit will be less than or equal to the $DCGL_W$. The detection limit target is 50 % of the $DCGL_W$. However, data may be used to support the RLC if the detection limit meets the $DCGL_W$ value.

For nonradiological instruments, PQLs shall be provided (based on formal PQL studies) with all results. PQLs shall be less than half the associated action level. Detection limits for nonradiological samples are described in Section 5.0.

7.4.2.5 Data Review

Data review begins with an assessment of the quality of the radiological survey/sample data and is performed by a professional with knowledge of the RLCP and applicable Radiological Safety Practices procedures. All radiological and nonradiological survey/sample data will be reviewed.

7.4.2.6 Data Quality Indicators

The assessment of data quality indicators is significant to determine data usability. The principal data quality indicators are precision, bias, accuracy, representativeness, comparability, and completeness (PARCC). Of the six principal data quality indicators, precision and bias are quantitative measures, representativeness and comparability are qualitative, completeness is a combination of both qualitative and quantitative measures, and accuracy is a combination of precision and bias.

Typically, a complete PARCC analysis is not required for radiological surveys/samples at the RLC stage, and only the qualitative indicators of representativeness, comparability and completeness need to be addressed. A more extensive data validation will generally be performed for nonradiological data, as described in the Section 8.4 introduction, based on the objective of the survey.

The intent of this section is to describe each data quality indicator, and provide examples of how each indicator is measured. The requirements for each RLC will be provided in the individual RLC survey packages.

Precision

Precision is a measure of agreement among replicate measurements of the same property under prescribed similar conditions. The two basic activities performed in the assessment of precision are estimating the radionuclide concentration variability from the measurement locations and estimating the measurement error attributable to the data collection process. Precision can be measured through the following sample types:

- Lab Replicates (rads)
- MS Duplicates (MSD)
- Field Duplicates
- Field Replicates (for scanning and direct measurements)

Precision can be quantified by at least two functions. The most typical measure for nonradiological analyses is the relative percent difference (RPD) term, whereas, because of the stochastic nature of radioactivity, a statistical measure is better suited for evaluating radiological reproducibility. This measure is referred to as the duplicate error ratio (DER). The equations for evaluating these two measures is provided below:

$$RPD = \frac{C_1 - C_2}{(C_1 + C_2)/2} * 100$$

where:

C_1 = first sample result (in terms of concentration)
C_2 = duplicate sample result (in terms of concentration)

$$DER = \frac{C_1 - C_2}{(TPU^2_{c1} + TPU^2_{c2})} * 100$$

where:

C_1 = first sample result (in terms of concentration)
C_2 = duplicate sample result (in terms of concentration)

TPU = total propogated uncertainty

Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias can be measured through the following samples or methods:

- Analytical spike samples.
- Field replicates (for scanning and direct measurements)
- Performance checks tracked with a control chart

Accuracy

Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from performing measurements. To be accurate, data must be both precise and unbiased. Accuracy can be measured through the following samples or methods:

- Calibrations
- Lab control samples/spikes (LCS)
- Matrix spikes (MS)
- Relative standard deviation (% RSD)
- Blanks
- Chemical yields (rads)
- Counting time (rads)
- Sensor efficiency (rads)
- Correction for ingrowth daughters (rads)

Generally, the accuracy of radiological surveys will be based on annual calibrations of instrumentation and daily source checks that perform within specified tolerances (e.g. +/-20%), as specified in the Radiological Safety Practices (RSP). Novel or prototypical instrumentation must also demonstrate compliance with the specified tolerances in the RSPs.

Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point. Representativeness is a qualitative term that should be evaluated to determine whether surveys/samples are collected in such a manner that the resulting data appropriately reflect the contamination present.

For the RLC, representativeness will be assessed by assuring that the survey/sampling requirements of the RLCP have been met. The surveys/samples obtained during the RLC will be compared with the survey/sample requirements in the RLCP. The impact of any discrepancies between the RLCP requirements and the actual survey/sample results will be assessed.

Comparability

Comparability is the qualitative term that expresses the confidence that two data sets can contribute to a common analysis. Differences in data sets need to be evaluated to assure that the data sets may be used for a common goal. If historical data will be used to support the RLC, the historical data will be assessed with respect to current data requirements in the RLCP. The comparability of the historical data set with the current data requirements will be assessed before the RLC is performed.

All data collected to support the RLC will be collected per RSP procedures or other approved procedures (for nonradiological sampling) and will therefore be comparable. The comparability of all surveys/samples to support the RLC will be assessed.

Completeness

Completeness is a measure of the amount of valid data obtained from the measurement system, expressed as a percentage of the number of valid measurements that should have been collected. Completeness is therefore a measure of the number of radiological surveys/samples obtained versus the number of radiological surveys/samples required per the RLCP.

Typically, 90% of the survey data required by the RLCP are needed to meet completeness requirements for the RLC. Any deviation from this requirement must be documented in the RLCR.

7.4.3 Data Quality Assessment

DQA is the scientific and statistical evaluation of data to determine if the data are of the right type, quality, and quantity to support their intended use.

There are five steps in the DQA Process:

1. Review the DQOs and survey design
2. Conduct a preliminary data review
3. Select the statistical test
4. Verify the assumptions of the statistical test
5. Draw conclusions from the data.

These five steps are presented in a linear sequence, but the DQA process is applied in an iterative fashion. The strength of the DQA process is that it is designed to promote an understanding of how well the data will meet their intended use by progressing in a logical and efficient manner.

Because no statistical evaluation of the radiological data is required for RLC, the DQA will be limited to steps 1 and 2. A more extensive DQA may be required for nonradiological sampling to satisfy regulatory requirements.

7.4.3.1 Review DQOs and Survey Design

The DQA process begins by reviewing the key outputs from the DQOs which are embodied in the RLCP. The RLCP provides the context for understanding the purpose of the data collection effort. It also establishes qualitative and quantitative criteria for assessing the quality of the data set for the intended use. The survey design in the RLCP provides important information about how to interpret the data. The RLCP and the survey design are reviewed before proceeding.

7.4.3.2 Conduct a Preliminary Data Review

In this step of the DQA process, a preliminary evaluation of the data set is conducted by calculating some basic statistical quantities and looking at the data through graphical representations. By reviewing the data both numerically and graphically, the "structure" of the data can be learned. This structure will identify appropriate approaches and limitations for data use.

The data may be examined statistically through calculating the mean, standard deviation, median, relative standing, central tendency, dispersion, shape, and association. The data may be examined graphically through the use of histograms, scatter plots, confidence intervals, ranked data plots, quantile plots, stem-and-leaf diagrams, spatial or temporal plots.

For the RLC, there are no requirements for assessing radiological survey/sample data statistically. Thus, there are no requirements for assessing the radiological survey/sample data in a graphical manner.

7.4.3.3 Select the Statistical Test

This section applies to nonradiological characterization data only. The statistical test performed to demonstrate compliance with the prescribed limits will be selected based on applicable guidance documents for regulatory requirements (see Section 11.0, References).

7.4.3.4 Verify the Assumptions of the Test

This section applies to nonradiological characterization data only. The assumptions applied in selecting the statistical test must be verified, and the data must be reviewed to assure that modifications to the statistical analysis are not warranted. This step involves the following three activities:

- Determine how the assumptions of the test will be verified (standard deviations, posting plots, histograms, power charts, etc.)
- Perform tests of the assumptions
- Determine corrective actions (if applicable)

7.4.3.5 Draw Conclusions from the Data

The conclusions of the statistical tests should support the objectives of the survey. The three activities involved with this step are:

- Perform the statistical tests
- Evaluate the tests and corresponding conclusions
- Evaluate the performance of the survey design for future use consideration

8.0 SURVEY REPORTING

Upon completion of the RLC surveys, an RLCR will be prepared. All measurement results used to demonstrate that the facility meets the RLCP DQOs will be presented in the RLCR. In the RLCR, a summary of the measurement results and overall conclusions showing that the facility satisfies the RLCP DQOs will be provided. As applicable, a tabular data summary will present the results for each area surveyed. This tabulation will identify the type and number of measurements performed, and the numerical results. For Type 1 facilities, the RLC results will be documented in a combined RLC/PDS Report.

8.1 Typical RLCR Outline

8.2 Reporting Characterization Findings

The documentation of RLC results is a RFCA-mandated report. This report will provide an analysis of characterization results and summarize the hazards and risks associated with the facility, including the nature and extent of radiological and chemical contamination and the types and volumes of wastes to be managed. Specifics will address the type and extent of strip-out and decontamination necessary, estimates on the types and volumes of waste anticipated, and controls needed for strip-out and decontamination, including PPE and environmental controls. Compliance with data review requirements will also be documented, as described in Section 8.4. The report should provide information in adequate detail to allow DOE to make a determination if the facility has significant contamination or hazards, as described in Attachment 9 of RFCA. DOE will use the information from the report to confirm its categorization of the facility, and will transmit the report and a notification letter to the Lead Regulatory Agency for concurrence.

8.2.1 Radiological Summaries

For each Type 1, Type 2, and Type 3 survey unit, the number of measurements and the applicable statistical distribution will be presented in tabular form. Graphical representation may also be included with the tabular data. For each type of surface contamination, measurements (total surface contamination, removable surface contamination, surface scans, and surface media sampling) will be reported in units of dpm/100cm^2. Volumetric sampling data will be reported in units of pCi/gram.

8.2.2 Chemical Summaries

The number of measurements and the applicable statistical distribution will be presented in tabular form, with additional graphical representation if applicable. The chemical data should be reported in the following manner:

- TCLP measurements will be reported in mg/L.
- PCB measurements will be reported in parts per million (ppm) or parts per billion (ppb).
- Be measurements will be reported in micrograms.
- Asbestos measurements will be reported as an asbestos percentage.

9.0 QA/QC PROGRAM

Quality assurance (QA) and quality control (QC) procedures are performed during implementation of the survey plan to collect information necessary to evaluate the survey results. Specifically, quality is an integrated system of management activities involving planning, QC, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. QC is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer.

Quality processes can both lower the chances of making an incorrect decision and help the data user understand the level of uncertainty that surrounds the decision. QC data are collected and analyzed during implementation to provide an estimate of the uncertainty associated with the survey results. QC measurements (scans, direct measurements, and samples) are technical activities performed to measure the attributes and performance of the survey. For any survey that may be used as a Pre-Demolition survey, a certain number of measurements will be taken for QC purposes as specified in Section 10.9.

Uncertainty in survey results arises primarily from survey design errors and measurement errors. Survey design errors occur when the survey design is unable to capture the complete extent of variability that exists for the radionuclide distribution in a survey unit. Measurement errors create uncertainty by masking the true level of residual radioactivity and may be classified as random or systematic errors. Random errors affect the precision of the measurement systems, and show up as variations among repeated measurements. Systematic errors show up a measurements that are biased to give results that are consistently higher or lower than the true value. Adequate planning should minimize known sources of uncertainty, and QC data collected during implementation of the survey plan provide an estimate of the uncertainty.

Precision is a measure of agreement among repeated measurements. Systematic errors, also called bias, accumulate during the measurement process and result from faults in sampling designs and procedures, sample contamination, losses, inaccurate instrument calibration, and differences in setting up or handling instruments by different operators. The magnitude of the measurement system variability will be evaluated to determine if it approaches or exceeds the true but unknown variability in the population of interest. Errors, bias, or data variability may accumulate to the point of rendering data unusable to achieve survey objectives.

To minimize the need for estimating potential sources of uncertainty, the sources of uncertainty will be reduced by implementing the K-H Quality Assurance Program (QAP). The implementation of the QAP will assist in using appropriate instruments and detectors, calibrating instruments to the extent practicable for the surfaces on which they will be used, using standard procedures, training and qualifying instrument operators on the instruments to be used, and performing QA/QC checks. Determining the usability of analytical results begins with a review of QC measurements and qualifiers to assess the measurement result and the performance of the analytical method.

This QA section defines the requirements and controls that are employed and implemented by K-H to perform RLC of adequate quality. QA criteria listed in this section plan supplement the QAP by emphasizing requirements applicable to planning and implementation of decommissioning activities. The application and implementation of these criteria into items and services shall be consistent with the graded approach and applied in project specific documents. The graded approach is a process of basing the level of application of managerial controls applied to an item or work according to the intended use of the results and the degree of confidence needed in the quality of the results. In practical terms, the graded approach requires selective application of QA requirements and control to items and services commensurate with their importance to safety and project objectives. The content and level of detail required for characterization activities is tailored to the nature of the work and associated risk with D&D projects.

9.1 Personnel Training & Qualifications

Personnel shall be qualified to perform their respective tasks based on a combination of education, training, and experience. This program is administered through the use of the K-H Training User's Manual, the Training Implementation Matrix and the Training and Scheduling Records database. These processes are designed to ensure that qualifications and training are maintained current for work assignments. Education and professional experience shall constitute the primary means of qualification for activities that emphasize problem-solving strategies, where creativity and innovation are essential components of optimizing the activity or item. Conversely, training shall be the primary means of qualification where consistency and team coordination constitutes a major component of the overall quality (or safety) of the process or item, and the process is well established, proven, and perfunctory.

Training requirements specific to a project can be given in a HSP, List of qualified individuals (LOQI) or a Training Implementation Plan. In addition, a project-specific QA/QC briefing shall be given during the pre-evolution briefing prior to project start-up in the field, and to new personnel prior to their participation on the project. The QA/QC briefing shall cover the project quality requirements and documented via the pre-evolution attendance roster. Quality personnel are qualified and certified in accordance with the K-H and company specific requirements for competency.

Fundamental education and experience are captured by transcripts and resume's, which are maintained by company-specific human resources or the subcontractor, as applicable. Project-specific training records are managed within the project file and the Training, Scheduling, and Records database. Qualification requirements and records may also be maintained through the project manager, individual staff, procurement within contractual agreements, and/or a centralized training group within a company or the Integrating Management Contractor (IMC).

Additional training will be required for personnel without prior experience or who will be performing surveys differently from those required during normal operations, as specified in RSP-16.05, *Radiological Survey/Sample Quality Assurance/Quality Control.*

9.2 Quality Improvement

Quality improvement shall be realized through use of a systematic means of identifying, tracking, and correcting issues (deficiencies, nonconformances, issues, etc.). Issues may be identified by any project personnel, at any time, through formal documentation of issues as stated in 1-MAN-012-SCARM, *Site Corrective Action Requirements Manual.* The extent of causal analysis and corrective action shall be commensurate with the significance of the failure or problem. Lessons learned shall be communicated to staff from management where appropriate.

The following documents implement quality improvement requirements:

- Site Corrective Action Requirements Manual (1-MAN-012-SCARM)
- Site Integrated Oversite Manual (1-MAN-013-SIOM)
- Site Lessons Learned/Generic Implications Requirements Manual (1-S27-ADM-16.18)
- Radiological Improvement Reports (1-H02-HSP-3.02)
- Stop Work Action (1-V10-ADM-15.02)
- Occurrence Reporting Process (1-D97-ADM-16.01)
- Performance Indication and Trend Analysis (1-E93-ADM-16.18)
- Control of Non-conforming Items (1-A65-ADM-15.01)
- Control of Waste Nonconformances (2-U76-WC-4030)
- RFETS Radiological Control Manual (Site RCM)

9.3 Document Control, Records, & Data Management

Work-controlling documents, such as work plans (including Integrated Work Control Packages -- IWCPs), standard operating procedures, and HSP, etc., shall be controlled in accordance with the Site Documents Requirements Manual where control is constituted by the following criteria:

- The documents are uniquely identified for reference purposes
- The required reviews and approvals are accomplished and
- The personnel who need the documents to perform work receive the latest approved versions of the document(s) prior to implementation

The document control process is described in procedure MAN-063-DC, *Document Control Program Manual.* Essential policies, plans, procedures, decisions, data, and transactions of the project shall be documented to an appropriate level of detail.

Quality records, including digital data stored on computerized media, shall be managed to ensure that information is retained, retrievable, and legible. Active records shall be maintained by project personnel, including subcontractors, in an organized and retrievable fashion, until such time that the records have served their purpose and become inactive. Quality records are considered active until the final peer reviews are conducted, thus, quality records are not subject to the 30-day limit on turnover to the Records Center until final peer reviews are conducted. Peer reviews of records must be conducted on records completed by the originator within two weeks of completion. Records at the job site shall be stored and protected in fire-safe boxes.

Quality records managed by contractors and subcontractors shall be transferred and archived in accordance with 1-V41-RM-001, *Records Management Guidance for Records Sources.*

Quality records resulting from direct measurements or technical sampling activities shall be authenticated by the originator and subsequently authenticated by a peer reviewer. For data uploaded to computer from the quality records described above, final data entry (as portrayed on hardcopy output) must be reviewed by someone other than the data entry person, and the hardcopy must be authenticated by the reviewer; errors on quality records shall be corrected by striking through the original entry with a line, and incorporation of the correct data adjacent to the strike-out. Authentication is also required for corrections.

Documents and records to be placed in the CERCLA Administrative Record shall be dispositioned via 1-F78-ER-ARP, *CERCLA Administrative Records Program.*

Kaiser-Hill Analytical Services Division is responsible for all original records produced concerning lab-generated chemistry and radiochemistry data; the projects shall use data as provided by K-H Analytical Services or their subcontractors.

Quality documents for decommissioning include but are not limited to the following:

- Field and laboratory measurement results and sample data
- Sample tracking and management records
- Test methods
- QC measurement records
- Personnel training and qualification records
- Procedures
- Deficiency and problem identification and corrective action reports
- Data handling records for data reduction, verification, and validation
- Data source assessment involving the evaluation and use of historical analytical data
- Analytical methods and detection limit evaluations
- Data review records

The following documents implement documents and records requirements:

- Site Documents Requirements Manuals
- Correspondence Control Program (1-L43-IMS-001)
- Records Management Guidance for Records (1-V41-RM-001)

9.4 Work Processes

All work shall be performed to established technical standards and administrative controls using approved instructions, procedures, or other appropriate means. Individual workers are responsible for the quality of their work. Management shall provide the workforce with the tools, materials, and resources (including training) necessary for successful accomplishment of their assigned tasks. Performance criteria for personnel shall be established and clearly communicated to the individuals.

9.4.1 Survey/Sample Handling and Custody

Samples will be managed to ensure there is an accurate record of sample collection, transport, analysis, and disposal to ensure that samples are neither lost nor tampered with and that the sample analyzed is traceable to a specific location in the field. A chain of custody form (RSFORMS-14.01-01 or equivalent) is to be completed for all samples submitted for laboratory analysis and will be included as part of the closeout survey documentation.

9.4.2 Survey/Sample Methods

Data are collected as specified in the survey package and in accordance with; RSP-16.01, *Radiological Survey/Sampling Design, Preparation, Control, Implementation, and Closure*, RSP-16.02 *Radiological Surveys of Surfaces and Structures*; RSP-16.03, *Radiological Samples of Building Media,*, RSP-16.04, *Radiological Survey Sample Data Analysis*, RSP-16.05, *Radiological Survey/Sample Quality Assurance/Quality Control* , and RSP-16.06, *Radiological Background Determination Plan*. The following documents implement work process control requirements:

- Configuration Change Control Program
- Integrated Work Control Program Manual
- Conduct of Operations Manual (Man-066-COOP)
- Site Documents Requirements Manual (1-MAN-013-SDRM)
- Integrated Safety Management System Manual (1-MAN-016-ISM)
- Radiological Control Manual
- Radiological Safety Practices Manual
- Health and Safety Practices Manual
- Radiation Protection Program Procedure (1-Q50-RPP-0001)
- Preparation and Control of RMRS Documents (RMRS-QA-05.01)
- QA Review of RMRS Documents (RMRS -QA-05.02)
- RMRS Quality Assurance Program Description (RMRS-QAPD-001, app 3)

9.5 Design

Sound engineering/scientific principles and appropriate technical standards shall be incorporated into designs to ensure that they perform as intended, including use of the RFETS *Conduct of Engineering Manual*. Final designs, as documents, quality records, or computerized data, shall undergo validation through peer review. Peer reviews shall be commensurate with the scale, cost, specialty, and hazards of the item or activity in question. Management approval, in addition to peer and quality reviews of designs, shall be effected prior to procurement, manufacture, construction, or actual implementation. Peer and quality reviews are corroborated through documented comment resolution of the design reviews.

9.5.1 Computerized Systems (Software/Hardware)

Design-control of computerized systems shall be commensurate with the hazards associated with the process for which the computer system controls. Systems controlling critical health and safety processes shall be verified and validated as prescribed in either the HSP or RSPs, and must simulate working conditions prior to usage in real settings. Such systems shall also be tested periodically to ensure functionality as defined in the RFETS *Radiation Control Manual* or the HSP. Computerized systems used for measurements shall be calibrated via system calibrations, i.e., while integrated with the relevant transducers. Computerized systems used for data reduction and analysis shall be controlled to:

- ensure traceability of changes made to original data
- allow independent peer reviewers to relate inputs to outputs

9.5.2 Radiological Survey/Sample Process Design

Data acquisition will be performed as specified in the RLCP and into specific survey packages for each facility. The following documents implement the design requirements:

- Configuration Change Control Program Manual
- Conduct of Engineering Manual (Design Process Requirements-COEM-DES-210)
- Computer Software Management Manual (1-MAN-004-CSMM)
- Operation Review Committee Requirements (1-52000-ADM-02.01)

9.6 Procurement

Procurement quality requirements shall be delineated in procurement and subcontract documents. All SOWs distributed by companies at RFETS shall be reviewed by quality personnel for quality requirements to ensure that adequate quality controls are imposed on the subcontractor. Ongoing oversite of the subcontractor shall be performed to ensure that these controls are implemented. Procurement requirements are implemented through the following documents:

- Procurement System Manual
- Acquisition Procedure for Requisitioning Commodities and Services (1-W36-APR-111)
- Conduct of Engineering Manual (Engineering Standards for Procurement –COEM-DES-273)

9.7 Inspection & Acceptance Testing

Items or activities that require inspections and/or acceptance testing shall be specified in work/control documentation Acceptance criteria and any hold points shall be clearly defined, and shall be based on the manufacturer's specification unless otherwise stated. Measurement and test equipment (M&TE) shall be accepted or rejected based on calibration information and pre-established tolerances, including unique identification, traceability, accuracy, resolution, measurement ranges, and acceptance/rejection criteria.

Materials and equipment that affect quality (of items or services) or health and safety shall be controlled, i.e., identified, maintained, and traceable according to the Site Measuring and Test Equipment Program. Measurement, monitoring, and data collection equipment shall be of the accuracy and resolution needed for their intended purposes based on calibrations. Calibrations shall be traceable to nationally recognized or industry standards. Essential policies, plans, procedures, decisions, data, and transactions of the project shall be documented to an appropriate level of detail.

Calibration sources are to be traceable to the NIST. Where NIST-traceable standards are not available, standards obtained from an industry recognized organization, e.g., the New Brunswick Laboratory for various uranium standards shall be used. The following documents implement inspection and acceptance testing:

- Inspection and Acceptance Test Process (1-PRO-072-001)
- Conduct of Engineering Manual (Design Process Requirements –COEM-DES-210)
- Control of Measuring and Test Equipment (1-I97-ADM-12.01)
- Computer Software Management Manual (1-MAN-004-CSMM)
- Waste Inspection Procedures Manual
- RFETS Radiological Control Manual (Site RCM)

9.8 Management and Independent Assessments

Management assessments shall be planned, scheduled and performed by project management to assess an organization performing work to determine if the objectives, goals and processes are adequate. Management assessment shall be documented through reports, internal memoranda, or other suitable reporting means.

Independent assessments are performed by personnel who are not directly responsible for the work to establish whether the prevailing management structure, policies, practices, procedures and data are adequate for ensuring that the quality of the results based on the risk and performance indicators needed are obtained. Deficiencies will be identified, tracked and closed in accordance with the *Site Corrective Action Requirements Manual.* Assessment requirements are implemented through the following documents:

- Site Integrated Oversite Manual (1-MAN-013-SIOM)
- RFETS Radiological Control Manual (Site RCM)
- Radiological Assessments (RMRS/OPS-PRO.150)

10.0 REFERENCES

3-PRO-165-RSP-07.02, *Contamination Monitoring Requirements*

10CFR830.120, Quality Assurance

American Society for Testing and Materials (ASTM) Method E1729-95, "Standard Practice for Field Collection of Dry Paint Samples for Lead Determination by Atomic Spectrometry"

ANSI/ASQC E4-1994. American National Standard, Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs

CBDPP Beryllium Characterization Plan

DOE/EM, 1995, Decommissioning Resource Handbook

DOE/RFFO, CDPHE, EPA, 1996, *Final Rocky Flats Cleanup Agreement*, Rocky Flats Environmental Technology Site, Golden, CO.

DOE Order 5400.5 - *Radiation Protection of the Public and the Environment*

EPA, 1996, Test Methods for Evaluating Solid Waste, SW-846, Third Edition

EPA, 1994. Guidance for the Data Quality Objectives Process, QA/G-4

EPA, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013

EPA, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-94/012

EPA, 1996. EPA QA/G-9. Guidance for Data Quality Assessment, Practical Methods for Data Analysis

EPA, 1997. EPA Requirements for Quality Assurance Project Plans, QA/R-5

Kaiser-Hill, 1997. Kaiser-Hill Team Quality Assurance Program, Rev. 5, 12/97.

Kaiser-Hill, 1998, *Decommissioning Program Plan*, October 8, 1998

Kaiser-Hill, 1999, RFETS Decontamination and Decommissioning Characterization Protocol

Lock-Heed-Martin, 1997. *Evaluation of Radiochemical Data Usability*, ES/ER/MS-5

MAN-077DDCP, *Decontamination and Decommissioning Characterization Protocol*, Revision 0

MARSSIM - *Multi-Agency Radiation Survey And Site Investigation Manual*, 12/97 (NUREG-1575, EPA 402-R-97-016)

Metals and PCB Characterization Procedure

NRC Reg. Guide 1.86 - *Termination of Operating Licenses for Nuclear Reactors*
OSHA Lead Standard (29 CFR 1926.62)

Occupational Safety and Industrial Hygiene Program Manual, Chapter 28.

RFCA, Attachment 5, "RFETS Action Levels and Standards Framework for Surface Water, Ground Water, and Soils"

RMRS, 1998. Quality Assurance Program Description (QAPD), RMRS-QAPD-001, Rev. 2, 4/98

Rocky Flats Administrative Procedure 2-G32-ER-ADM-08.02, Evaluation of ERM Data for Usability in Final Reports;

SA/94-003 "Proposed Statistical Methodology for Sampling and Analysis in Support of Beryllium Surveys" by D.M. Splett and D.R. Weir, dated 1/31/94, and an Addendum, SA/94-005, dated 5/17/94.

11.0 GLOSSARY

Bulk Sample –

Composite Sample - A sample that represents a large area. It may consist of several small samples from various locations which are contained in a manageable sample that is representative of the entire area.

$DCGL_W$ - Derived Concentration Guideline Level - Contamination limit based on the assumption that the concentration of residual activity is evenly distributed over a large area.

$DCGL_{EMC}$ - Derived Concentration Guideline Level - Contamination limit based on the assumption that the concentration of residual activity is distributed as small-elevated areas within a larger area.

Impacted Class 1 Areas - Areas that have potential contamination (based on building operating history) or known contamination (based on past or preliminary characterization survey data). This would normally include areas where radioactive materials were used and stored and where records indicate spills or other unusual occurrences could have resulted in the spread of contamination.

Impacted Class 2 Areas - Areas that have or had a potential for radioactive contamination or known contamination, but are not expected to exceed the applicable contamination limits.

Impacted Class 3 Areas - All areas not classified as Impacted Class 1, Impacted Class 2 or Non-impacted. These areas are not expected to contain residual contamination above the applicable limits, based on knowledge of building history and previous survey information. However, insufficient documentation is present to exclude the area from survey requirements.

Judgmental Scan Surveys - Scan surveys that are performed at locations with the highest potential for contamination (e.g., horizontal surfaces, high traffic areas, floor corners, drains) based on professional judgment.

Local Area Background - Background survey instrument readings taken at specific locations within a survey unit in order to determine actual contamination values in a more precise manner.

Non-Impacted Areas - All areas not classified as Impacted Class 1, Impacted Class 2 or Impacted Class 3. These areas are areas where there is no reasonable potential for residual contamination, based on knowledge of building history and/or previous survey information. Sufficient information is present to be assured that no residual contamination is present above the applicable contamination limits.

Measurement Location - A survey location where the typical set of total surface contamination and removable contamination measurements are obtained.

Minimum Detectable Activity - The minimum amount of activity that can be statistically detected above background with a 95 percent probability and with a maximum of 5 percent probability of falsely interpreting sample activity as activity due to background

Survey Area - The most general category, comprised of surfaces to be further defined as one or more survey units, the bounds of which are defined by existing physical features such as walls, columns, beams etc.

Survey Unit - A contiguous area with similar characteristics and contamination potential. Survey units are established to facilitate the process and aid in the statistical evaluation of the survey data

Survey Design - The process of determining the type, location, number and density of radiological measurements to be taken for final survey

Survey Package - A collection of information in a standardized format for controlling and documenting field measurements taken for final survey. A survey package is prepared for each Survey Unit. The survey package typically includes the survey instructions, survey data sheets and grid maps.

Survey Point - A smaller subdivision within an area designated as a survey location where measurements are obtained. This area generally refers to the area covered by a detector probe or 100 cm^2 when a smear is obtained.

Survey Instructions - Written instructions which specify the type and number of measurements to be taken in a survey unit. Each survey package shall include survey instructions.

TCLP – Toxicity Characteristic Leaching Procedure; determines the mobility of organic and inorganic analytes present in liquid, solid, and multiphasic wastes.

Judgent Sample – Located directly at a location suspected as being the site of a contamination or spill

Random Sample – Taken within predefined boundaries for definition of the population.

12.0 APPENDICES

Appendix A

Radiological Summary Table

APENDIX A
RADIOLOGICAL SUMMARY TABLE

Media & Volumetric Sampling		Maximum Survey Area Size	Number of Surface Activity Measurements	Surface Scanning	Media & Volumetric Sampling	Isotopic Gamma Scans
Non -Contamination Areas, Radiological Buffer Areas, and Radioactive Material Areas	Floors and Walls Below 2 meters	Up to 2000 m^2 (based on floor area)	30 uniformly distributed measurement locations plus biased measurements at suspect locations	1 m^2 at each measurement location, plus perform judgmental scans at biased locations	Biased samples may be collected based on RE judgement	Biased isotopic gamma scans may be collected based on RE judgement
	Ceilings and Walls above 2 meters	Up to 2000 m^2 (based on ceiling area)	10 measurements at biased, assessable locations.	No scanning required unless contamination is discovered Biased scanning may be performed based on RCT and RE judgment		
	Equipment	Up to 2000 m^2 (based on floor area)	30 measurements at biased, assessable locations.			
	Exterior Walls and Roofs	Each Facility	30 uniformly distributed measurement locations plus biased measurements at suspect locations			
Contamination Areas and Fixed Contamination Areas	Floors and Walls Below 2 meters	Up to 1000 m^2 (based on floor area)	30 uniformly distributed measurement locations plus biased measurements at	1 m^2 at each measurement location, plus perform judgmental scans at biased locations	Biased samples may be collected based on RE judgement	Biased isotopic gamma scans may be collected based on RE judgement
	Ceilings and Walls above 2 meters	Up to 1000 m^2 (based on ceiling area)	30 measurements at biased, assessable locations.	No scanning required unless contamination is discovered. Biased scanning may be performed based on RCT and RE judgment		
	Equipment	Up to 1000 m^2 (based on floor area)	30 measurements at biased, assessable locations.			
	Exterior Walls and Roofs	Each Facility	30 uniformly distributed measurement locations plus biased measurements at suspect locations			
High contamination Areas and Airborne Radioactivity Areas	No Surveys or Sampling Required					

Appendix B

Instrumentation

APPENDIX B
INSTRUMENTATION

Instrument	Count Type	Allowable Bkgd Counts	Acceptable Application	Typical MDC for total alpha activity measurements (dpm/100 cm^2)	Maximum Acceptable Scan Rate (in/sec)
NE Electra w/ DP6 Probe	60 sec.	2	Direct Alpha Surveys (Total Activity)	37	1/2 in./sec.
Tennelec Low Level Alpha Beta System	2 min. (alpha)	0.5	Removable Alpha Swipes	10	N/A

Portable Instruments

The above instrumentation parameters, including maximum acceptable scan rates, are based on the following:

Current RFETS operating procedures
The NE Electra used to perform alpha scans provides the ability to detect the following: 1) a single count at a ½ inch/second scan rate > 50% of the time, and 2) a 2nd count within a reasonable period of time (6 seconds), 90% of the time at the alpha DCGL$_{\cdot W}$ of 100 dpm/100 cm^2. In addition, the scan MDC of the NE Electra at 1½ in./sec. is less then the applicable DCGL$_{EMC}$ for alpha in accordance with Technical basis document and applicable addendum, *Methods to Demonstrate Compliance with Performance Requirements for Swipe Counting and Portable Contamination Survey Instrumentation used to Evaluate Property and Waste for Unrestricted Waste, 6/7/1995*
Scan rate calculations performed in accordance with MDC scan formula from MARSSIM, Section 6.7.2.2

Laboratory Instrumentation

Typical laboratory instrument is used for on-site analysis and includes, but is not limited to, alpha spectroscopy systems, gamma spectroscopy systems, low background alpha/beta gas flow proportioned systems and liquid scintillation counting systems. MDCs are determined on an individual basis for each sample to be analyzed. Adequate sample volume will be obtained to ensure MDCs of approximately 50 percent of the applicable DCGLs are obtained for all RLC survey data. Analysis of solid samples for material to be released in accordance with the No-Rad-Added program will be required to achieve an MDC of 50 percent of the applicable background value as delineated in 3-PRO-140-RSP-09.03, *Unrestricted Release of Bulk or Volume Material.*

Other Instrumentation

SCMs may be utilized for portions of the RLC survey. MDCs for the systems are determined on an individual basis at the time the survey measurements are obtained. Other site-approved instrumentation may be utilized as required by Radiological Engineering. Surface media/paint sample MDCs after converting to dpm/100 cm^2 will be verified to be approximately 50 percent of the applicable DCGL$_{WS}$ for all RLC survey data obtained with this instrumentation.

134/134